SCIENTIFIC AMERICAN

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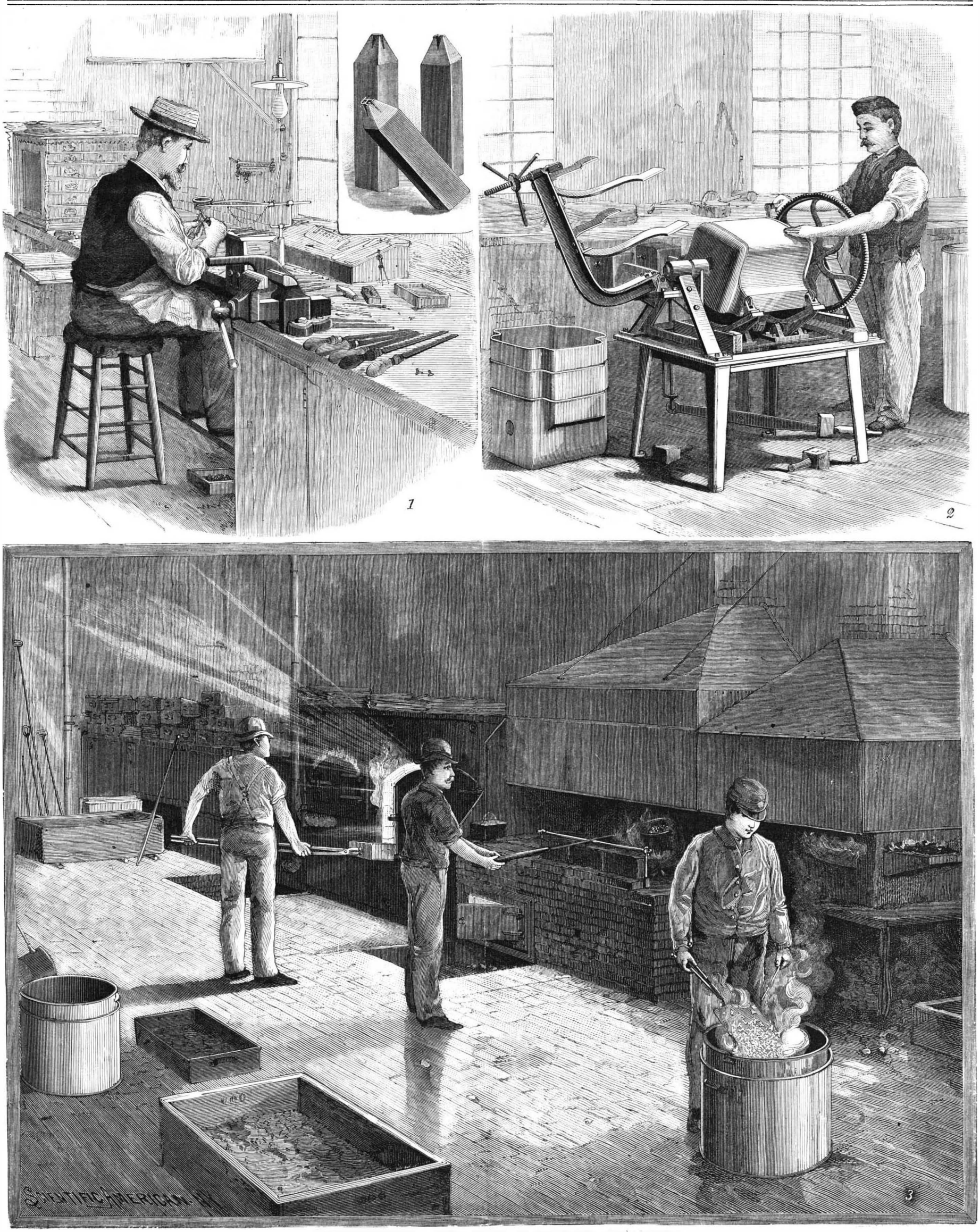

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MANUFACTURE OF THE REMINGTON TYPEWRITER.—[See page 374.]

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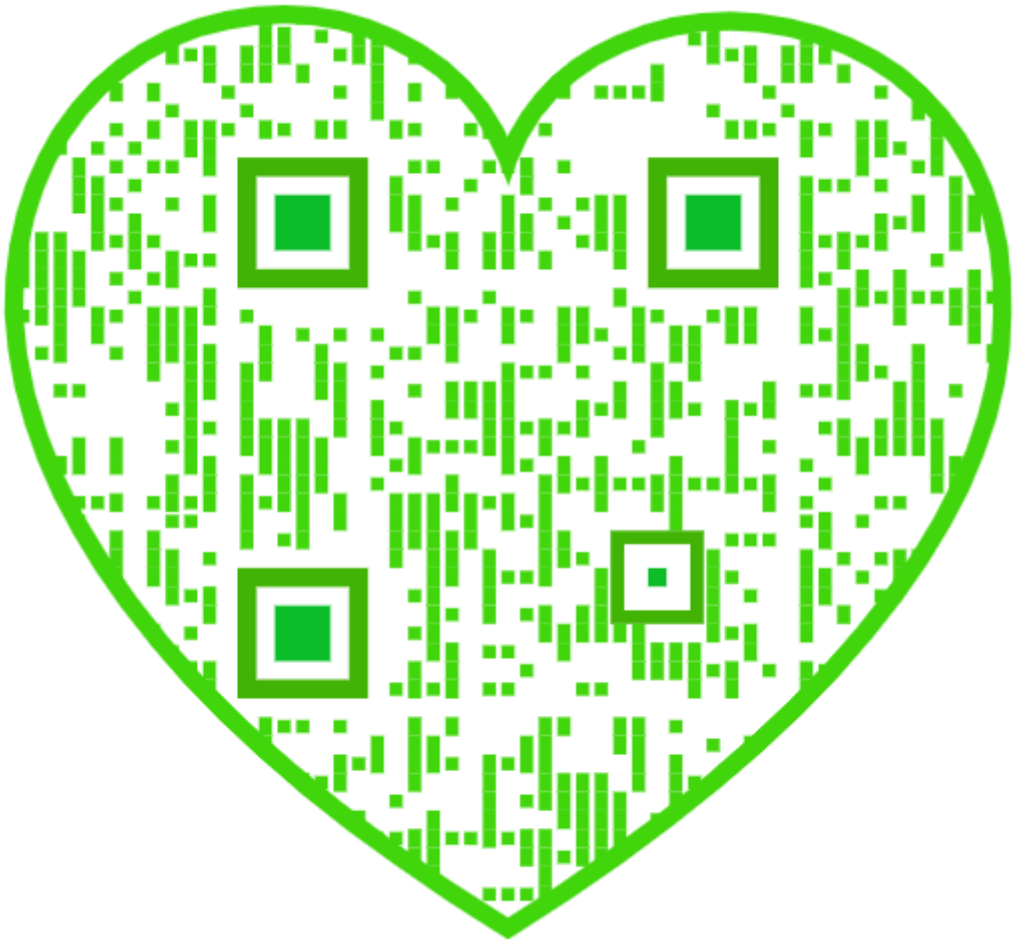

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EXPERIMENTS ON DEATH BY ELECTRICITY.

At Mr. Thomas A. Edison's laboratory in Orange, N. J., the effects of electricity were tried upon larger animals than have hitherto been experimented with, under the charge of Mr. Harold P. Brown. The experiments were witnessed by Mr. Elbridge T. Gerry and others. A calf weighing 124½ pounds was first selected. Its resistance was determined, and was 3,200 ohms. An alternating current of 700 volts E.M.F. was applied and continued for 30 seconds. This was needless, as death was instantaneous. On dissection, its flesh and principal organs were found to be unaffected. The circuit wire was connected to a prepared bare spot on the forehead and to a second spot, also denuded of hair, upon the spine. Sponge-covered electrodes, moistened with sulphate of zinc solution, were employed.

A second calf, weighing 148 pounds, resistance 1,300 ohms, was killed instantly by the same current. The current was only applied for five seconds. Finally, a horse, weighing 1,230 pounds, resistance 11,000 ohms, was killed, the current passing from one fore leg to the other through the body. The demonstration was addressed to the members of the committee who recommended for capital offenses the substitution of death by electricity for the statutory death by hanging. It is also interpreted as illustrating the deadly nature of the alternating current. Proof of this after the number of deaths which have occurred from the direct current in this city seems quite timely. The distinguished inventor in whose laboratory the experiments took place is the principal advocate of the direct system of electric lighting.

THE WEBSTER-HIGGINS PATENT SUIT.

The accounting in a great patent suit has been brought to a close by Commissioner Shields, before whom the proceedings for accounting had been brought. The patent in suit, granted to Wm. Webster in 1872, referred to the placing and withdrawing of the wires used in raising or forming the pile in the manufacture of Brussels carpet. Originally the work was done by hand; then, under the Bigelow patent, a monopoly was held, until 1871, for executing it by machinery. When this expired, many concerns began to use mechanical appliances which seemed to infringe the Webster rights. Shortly after its granting, a company with $200,000 capital was formed, to sue infringers under this patent. The great case now decided was brought against the Messrs. Higgins, and four years, from 1874 to 1878, were consumed in bringing it to the final hearing in the U. S. Circuit Court. The complainants were originally represented by Messrs. Clarence A. Seward and E. N. Dickerson; the defense retained George Gifford, Esq., Judge Hoar, and Senator Evarts. Judge Wheeler, before whom the case finally came, decided in favor of the defendants, and held the patent invalid. This decision after four years had passed was reversed by the U. S. Supreme Court, and an accounting was ordered. It was here that the remarkable features of the case began to appear. Two years were devoted to it. The documents finally produced weighed two tons.

Mr. George Gifford died, and his son Mr. Livingstone Gifford succeeded him in the management of the case, and Roscoe Conkling was also retained by the prosecution. A claim was presented by the representatives of the Webster patent right for over $28,750,000. One witness, the expert bookkeeper and president of the Webster Iron Company, was subjected to a cross examination extending over two years. Nearly 6,300 interrogatories were embraced in his testimony, the record of which covered between two and three thousand printed pages. The great claim was by this examination reduced to $1,500,000, an average of over $4,000 per question asked. The Messrs. Higgins' proofs on the accounting filled 1,200 pages. Eleven days were consumed in the argument, and over a thousand pages of brief were handed the Master. His final decision practically throws out the patent in suit as an element for damages, and the Webster Loom Company are awarded nothing.

The cross examination of Mr. Smith, the president of the prosecuting company alluded to above, is the most remarkable on record. The eminence of the counsel and the visitations of death among them and the other parties also signalize the case. Messrs. George Gifford, Roscoe Conkling, Judge Hoar among the counsel, and the patentee and one of the original defendants, Mr. Nathaniel Higgins, are dead.

Lectures for Workingmen and Women.

The school commissioners of the city of New York authorized at their meeting on Wednesday, December 5, lectures for workingmen and workingwomen, to be delivered twice a week, at night, in schools in the Tenth, Twelfth, Thirteenth, Nineteenth, and Twenty-second Wards. These lecturers have been selected: Prof. L. J. B. Lincoln, Prof. Henry A. Mott, Dr. T. O'Conor Sloane, Charles S. Allen, M.D., Henry G. Hanchett, M.D., Edward H. Boyer, Stephen Helm, Francis G. Caldwell, Nathan S. Roberts, M.D., H. M. Leipziger, Prof. J. C. Zachos, Geo. A. Clement, Prof. Bickmore, and J. Oscroft Tansley, M.D. This is an innovation in the line of public education from which much is to be hoped and whose results will be watched with much interest.

Bursting of the New Steel Gun.

The hopes which were entertained of producing cast steel guns of sufficient strength to stand the requirements of actual service have met with a serious check if not final disappointment.

The new steel gun which was carefully cast by the Pittsburg Cast Steel Co., after being finished and rifled, was taken to the government proving grounds at Annapolis, Md., and subjected to trial on December 5. The gun was 193 inches in length, and was to be tested with 38 pounds of powder on the first charge, and 48 pounds for ten consecutive shots following. It carried a 100 pound conical shot, which was to be fired into the earth bank 200 yards away. All the visitors were supplied with bomb-proof stations, some with glasses and others with peep holes, giving a view of the gun at the discharge.

The first discharge was made with 36 pounds of powder, at the request of the makers, "to warm up the gun," they said. The gun stood this test, a pressure of 11 tons to the square inch. The second load contained 48 pounds of powder, the regulation charge. With a tremendous roar the second discharge came, startling the auditors and spectators. It had done its work. The great gun lay dismantled under the huge timbers of the platform that had been utterly demolished, heavy timbers of 12 by 12 inches having been splintered into fragments. The government lost $5,000 by the destruction of property in the explosion. Ensign Robert R. Dashiell said that the experiment proves that the Bessemer cast steel will not do for great guns. The gun exploded under a pressure of 14·1 tons to the inch. It was broken from the trunnions to the butt in over twenty pieces. From the trunnions to the muzzle it remained in one piece. The ball deflected about 20 feet above where it was aimed. The gun showed weakness in the breech, where it ought to have had strength. The fragments of the gun all flew backward.

An investigation is to be made, with a view to discover, if possible, the exact causes of the disaster.

A Volatile Alkaloid in Pepper.

BY WILLIAM JOHNSTONE, PH.D., F.I.C., ETC.

The subject of this short note is to announce the existence or discovery of a volatile alkaloid in pepper possessing strong alkaline properties. The analysis of its platinum salt gave the following results:

		Found.	Calculated.
C	120·0	20·02	20·60
H	24·0	4·32	4·15
N	28·0	5·01	4·80
Pt	197·4	33·93	33·89
Cl	213·0	36·62	36·56
$2(C_5H_{11}N.HCl)PtCl_4$	582·4	99·90	100·00

These results so closely agree with the formula of piperidine that I think I am justified in announcing the existence of piperidine in pepper.

I have made several estimations of this volatile alkaloid in various peppers, and find that nine samples of black pepper gave an average of 0·56 per cent, with a minimum of 0·39 per cent and maximum of 0·77 per cent calculated as piperidine.

Long pepper contains 0·34 per cent, and pepper refuse, composed principally of the husks, 0·74 per cent.

Three samples of white pepper gave respectively 0·34, 0·21, and 0·42 per cent, showing that the alkaloid is contained principally in the husk, and which naturally accounts for the greater pungency of black pepper over that of white pepper.

The same samples of black pepper were examined for piperine and the amount estimated, giving a maximum of 13·03 per cent, a minimum of 5·21 per cent, and a mean of 8·25 per cent.—*Chemical News.*

The Proposed Quaker Dam.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. A. Marichal discussed the plans of the Quaker Bridge Dam, as proposed by the board of experts appointed by the New York Aqueduct Commission, and made comparisons between them and the plans presented by himself to the commission at the beginning of this year.

Mr. Marichal says that the report of the board of experts contains certain errors of such a nature as to make it almost worthless; that this report represents his plans as to be built on a straight line, while four pages out of seven of the pamphlet accompanying his plan are devoted to demonstrating that the dam should be built on a curve. He, moreover, says that he was one of the first to criticise the straight line in plan (see *Proceedings*, January 14 last).

The author of the paper went into a mathematical demonstration, having for its object to prove that the calculations made by the board of experts to ascertain the leverage, the frictional and the granular stability of the profile were based on wrong theory; and that his profile, built on a curve of 900 feet radius, would make a much stronger dam than the one proposed by the board of experts, and that the cost would be less by half a million dollars.

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The French Sheep Farm.

M. Gustave Heuze contributes to the *Journal d'Agriculture Pratique* an interesting account of the national sheep breeding farm (*bergerie*) at Rambouillet, which has now been in existence for more than a century, King Louis XVI. having purchased the palace and forest of Rambouillet in 1784, and having created an experimental farm on the estate, at a cost of about £1,600 in the money of that day, now representing, of course, a much larger sum. The manager of the farm, one Tessier, then obtained the king's permission to spend more than double the sum in the purchase of Fribourg cattle, Angora goats, implements, and the cultivation of different varieties of wheat, clover, etc. But the great service which Tessier did was the introduction of the merino sheep which have since made Rambouillet so well known. These sheep had originally been brought from Spain some few years before, on account of the excellence of their wool, and Tessier, having seen them at various places in France, induced the king to order the French ambassador at Madrid to purchase a flock of 364 sheep, which were selected from among the choicest flocks in Spain, at a cost of £650. The sheep, on their arrival at Rambouillet, were placed under the charge of a man named Delorme, who was still shepherd when Napoleon came to Rambouillet in 1804, and complimented him by calling him the "first shepherd in France."

The flock was re-enforced two or three times by fresh importations from Spain, and it was the custom to hold an annual ram sale from 1794 to 1853, but in the latter year this was given up, and since then the sales have been private. The change was a beneficial one, for while the highest prices at public auction were £17 for rams and £5 for ewes, the average price for the twenty years from 1853 to 1872 was £34 for the rams and £16 for the ewes. The total value of the sheep sold out of the Rambouillet flock from 1797 to 1872 was £139,000, represented by 4,309 rams, 4,301 ewes, 3,025 wethers, and 131 tons of wool. Although the value of the stock increased considerably during this period, the wool dropped from 1s. 9d. per pound to just half that price. There is a great diversity of opinion as to the origin of the merino sheep, some people saying that the breed was introduced into Spain by the Moors, and that it originally came from Asia; but there does not seem to be any special reason for believing such to be the case, and it is, of course, equally impossible to identify it, as some others have endeavored to do, with any of the Roman breeds spoken of by Pliny. There can be no doubt, however, in M. Heuze's opinion, that the merino sheep brought from Spain have been much improved, both as regards the development of the frame and the growth of wool, since their importation to Rambouillet, and the rams are much sought after by breeders in Australia, New Zealand, and South America, as it is found that the climates of these countries suit them very well. A very favorite cross in France is that of the merinos with the Leicesters, and the animals bred in this way, which are known as "Anglo-merinos," are generally notable for their early maturity, good conformation, and fine clip of wool.

New Westminster Southern Railway.

This new enterprise in the province of British Columbia is of more than local importance, and running from the Fraser River to Seattle in Washington Territory completes, says *Engineering*, the Pacific Coast Railway from Mexico to Canada. New Westminster on the Fraser River was formerly the capital of British Columbia, when the island of Vancouver was a separate province, but when the two were merged into the one province, it lost this distinction in favor of Victoria, the more important city of the two, and formerly the island capital.

When the Canadian Pacific Railway was diverted from the Fraser River Valley (by which it passes through British Columbia), and carried across the Pitt Marshes to Port Moody for a terminus, New Westminster was again left out, and lost the terminal advantage that seemed to belong to it as the best situation near the mouth of the Fraser; while when the Canadian Pacific syndicate extended their line from Port Moody to the new city of Vancouver, and exerted all their influence to make this the great city of the West, New Westminster got a third set-back, from which it will have some difficulty to recover.

Aroused to the necessity of making every exertion to save the remains of their business from being diverted either to Victoria or Vancouver, the old community have taken hold of this new railway scheme, and as they have lost the Fraser River trade and the terminal advantages of the transcontinental railway, are taking the best means to secure the southern outlet from the province. They have accordingly liberally bonused the new scheme. They gave the company $150,000 for the road, $75,000 for a ferry across the Fraser, and $75,000 for their locomotive and car shops, which must be built within or in the vicinity of the city on the north side of the Fraser River. Considering that the ratable property of New Westminster by the last assessment was only $862,511, this bonus equals more than one-third of the total valuation, and seems exceedingly, perhaps imprudently, liberal, but it is looked upon as a necessary investment, and the only means by which the city can retain its position. It is intended ultimately to bridge the Fraser, and for this a further bonus is promised, but as the river is 90 feet deep and very wide, this for the present is postponed, and the trains are to be crossed by a ferry.

The New Westminster Southern will be 126 miles long from the Fraser River to Seattle, of which about 30 miles is in British Columbia and the remainder in the United States. The line runs through a wonderfully rich country. It is heavily timbered, 12,000 million feet of lumber being, it is estimated, within the two and a half miles belt of land donated to the railway. The company has also secured some valuable coal lands, with two known workable seams of coal, each three feet six inches in thickness, and they have immense beds of iron ore, said to be 156 feet in thickness and assaying 56 per cent of iron, practically inexhaustible, on their freehold. The agreement with the city of New Westminster was signed September 5, and provides that work shall be commenced within thirty days, be completed to the boundary in twelve months, and to Seattle within four years. At the end of the month the whole distance to the boundary was cleared of its timber, and the right of way had been secured, the contract for the grading was let, and the contractor expects to have the rails laid on this section by the end of March next. The whole of this is much against the interest of the Canadian Pacific Railway, who are now surveying a parallel route to start from Vancouver, and missing New Westminster to cross the Fraser at Sea Island, about five miles further up the river.

The Marriage of Near Kin.

There is a widespread idea that consanguineous unions produce either defective offspring or none at all. When a marriage between cousins is spoken of, sterility or a deaf-mute, idiotic, or deformed progeny is predicted, and examples are always at hand to cite in support of the prophecy.

Does this opinion rest upon positive and well authenticated facts, or is it erroneous? This is a question that was examined a few years ago by Mr. G. H. Darwin, who, after a profound study of the subject, came to the conclusion that, in the present state of science, there is nothing to justify the common prejudice that exists against the marriage of near kin. More recently, the subject has been further examined by Mr. A. H. Huth, who has just published an exhaustive work upon it, in which he arrives at the same conclusions that Mr. Darwin did.

Mr. Huth thinks that consanguinity of itself plays no particular role in the union of individuals of the same stock. In the descendants, it increases the tendencies common to the two progenitors. By reason of their relationship, the closer this is and the closer the relationship of the ancestors, the greater is the tendency of the descendants to exhibit the same dispositions. If these are good, consanguineous unions will be advantageous, in that they will fortify and intensify them. If, on the contrary, they are bad, such unions should be avoided, in order to prevent a re-enforcement of unfavorable tendencies, which should be suppressed. But the case is identical where it is a question of unrelated persons. No reasonable person would urge two neuropathic individuals of different family to unite, because he knows that the neurosis has every chance to become intense in the descendants. On the contrary, a union between consanguineous individuals, equally healthy and well favored, ought to be encouraged. What may be urged against marriages of near kin is the facility with which unfavorable tendencies are transmitted, and the relative rarity of the circumstances in which such marriages can really be advised. But, this admitted and explained, consanguinity of itself presents no inconvenience, especially if we consider how remote, by reason of the existing laws upon marriage, is the degree of consanguinity between individuals capable of uniting legitimately.

Upon the whole, consanguinity accumulates and intensifies tendencies. If these are bad, the marriage of near kin should be avoided; if good, it may be favored. But as, unfortunately, the unfavorable tendencies are more easily and frequently transmitted, because they are the ones that are established with the most facility, there is oftener more reason for avoiding than seeking such unions. Upon the whole, Mr. Huth concludes that the accusations directed against marriages of near kin are not justified in the present state of science.

Explosion of Dust.

At Saginaw City, Mich., November 29, a terrific explosion, at a quarter to one P.M., shook the city, and was closely followed by an alarm of fire from the direction of the Steglein furniture factory, standing nearly in the center of the city. When the firemen reached the scene, the factory was demolished and enveloped in flames—the wreck was complete. The cause of the explosion was an accumulation of dust. The men had just left for dinner, or the loss of life would have been frightful.

Dr. Henry B. Sands.

By the death of Dr. Sands, which occurred on the afternoon of November 18, America lost her surgeon of greatest reputation. He was fifty-eight years of age. He graduated in 1854 at the College of Physicians and Surgeons in this city. He prosecuted his studies after this for several years abroad, and then, returning, commenced the active work of his profession. He was of the aggressive type, adopting and utilizing the latest surgical discoveries. His achievements in laparotomy have lately attracted much attention. He attended General Grant and Roscoe Conkling in their last illnesses. In the case of Mr. Conkling, he raised a portion of the skull with mallet and chisel to relieve the sac of pus that had formed. His skill as a surgeon was devoted principally to the active work of his profession, and it is a matter of regret that he left no more permanent literary monument of his life's work. It is said that he intended to do so. He lectured in various colleges, and his connections with them and with hospitals and scientific societies were very extensive. His death was sudden, occurring while he was riding in a carriage with a friend.

Artesian Wells in Memphis.

The cities of the Mississippi valley have never been noted for the purity of their water supply, as they have depended largely on river water. Recently, the city of Memphis has been experimenting with artesian wells, and has found an inexhaustible supply of the best water directly under its site. A true artesian basin covered by a perfectly impervious stratum has been discovered, which is now fast displacing the unsatisfactory Wolf River as a source for water. Hitherto this river has supplied the city's wants. Thirty-two artesian wells have been driven over an area 2,000 by 300 feet. They are driven to a depth of about 450 feet. They first pass through 20 feet of bluff loam, then through 24 feet of sand and gravel, and finally through 150 feet of hard, impervious clay. The water-bearing stratum is then reached, which consists of perfectly clean sand seven hundred feet deep. The water rises far above the level of the Mississippi River. Permanent works are now in progress. A large well is to be sunk 80 feet below the surface. From this a horizontal tunnel 2,000 feet long will be carried through the hard clay. This tunnel will be five feet in diameter, and the wells will be connected with it. The water will be pumped from the large well. The tunnel can be extended indefinitely, and more wells can be bored as the supply may need extension. The temperature of the water is practically uniform, and averages about 62° Fah. It is impossible to overestimate the importance of this development as far as Memphis alone is concerned. But the same basin includes many other cities, and eventually a large area may be benefited by the discovery so happily made at Memphis. Mr. R. C. Graves, manager of a local ice company of that city, had used artesian water for making ice, and to him is largely due the credit for the new Memphis water supply.

Short Smoke Boxes and Open Stacks.

A locomotive engineer, writing to the *Railroad Gazette*, says:

Most of our engines are still run with a diamond stack and short smoke box with the petticoat pipe for leading the steam into the stack. The thing is all right except that the cone inclines to scatter the sparks all over the first cars of the train, and it trails the smoke and gases so they fill the cars. It is well known that the open stack lets everything go straight up into the air. That, in my eyes, is the advantage of having an extended front.

It is not the three feet of extra smoke box that keeps an engine clean. It is the open stack that gives a long smoke box its popularity. The putting on of the addition to a smoke box is costly, and the extra weight makes the truck run hot. I am in favor of the open stack, but I favor democratic simplicity and keeping to first principles even in building locomotives. The ordinary smoke box, with the nozzles level with the third row of flues from the bottom, and a plain petticoat, pipe, has been found all right.

Nothing better has been tried since George Stephenson gave to posterity a perfect locomotive. I could write for an hour stating objections to the extended smoke box. Then why not use the smoke box as we find it, with an open stack, and have all the good things working together? The right place for the nozzles is at the bottom of the smoke box. That has been proved. Now, here is my plan. Throw aside your stack with the cone and netting to suppress the draught, and put on an open stack as long as it could be set to clear, and prevent spark-throwing by putting a netting across from the flue sheet to the smoke box casting. This would be the extreme of simplicity, and I would like any one to show what there is to prevent it working to perfection. The contrivance is cheap and simple. By its use no sparks would be pattering on the front cars all the time, ruining the paint. The passengers would not be suffocated with smoke and dust, and the front end of the train would have a modern appearance.

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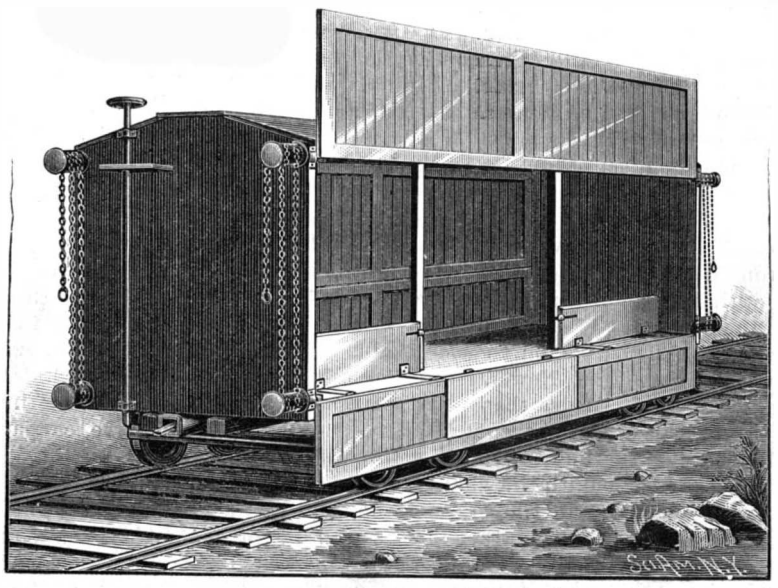
AN IMPROVED FREIGHT CAR.

An improvement providing a box freight car with doors extending the entire length of the car, with means for operating and securing them, has been patented by Mr. Hermann L. P. C. Hartmann, and is illustrated herewith. Each upper door is hinged to an upper beam and each lower door to a lower beam of the car body, hinge pivots projecting at the ends of the car carrying top and bottom pulleys. Over these pulleys, at each end of the car, passes a chain which is first secured by one end to the top pulley, around which it is wound several times, then passed over and around the bottom pulley, and again over the top pulley, the end hanging down having a ring to pull upon, whereby the doors may be opened and shut. On the inside of the top of the car, on one or both sides, are pivoted posts, which may be locked against the car roof by hooks, and which when swung down serve as supports for low doors, pivoted to the car floors, which may be locked against them. When the operator desires to place long articles, such as logs, etc., in the car, he entirely opens both the side and the interior doors, throwing open the entire side of the car, although, if desired, the lower door may be placed horizontally on suitable supports, such as a wagon from which articles are being loaded into the car, when the upper door will also be held in a like position.



HARTMANN'S FREIGHT CAR.

For further information relative to this invention, address Mr. H. L. P. C. Hartmann, care of Paul Brummer, Bay Ridge, L. I., N. Y.

A SUPERFICIAL HEATER FOR BOILERS.

A feed water heater for stationary boilers, designed to most effectively utilize all the heat given out by the fuel consumed, is shown in the accompanying illustrations, and is the invention of Mr. L. H. Willard, of Rutland, Vt. These heaters are of steel boiler plate, and for an ordinary four-foot boiler are three inches thick, 7½ feet long, and 5 feet high, as shown in Fig. 1. They are placed on each side of the fire box, next to the fire, as shown at B B, Fig. 2, doing away with the use of fire-brick. The heaters are connected with the boiler by pipes near the top of the heaters, the water being taken into the heaters at the bottom, and be-

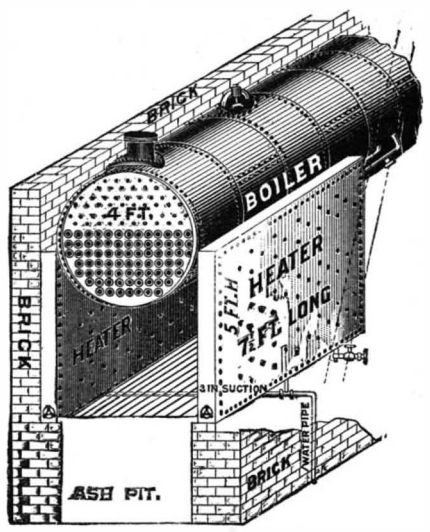


Fig. 1.

coming heated to a high temperature before it is admitted to the boiler. There is also a bridge wall heater, shown at F, which is adjustable to give more or less space between its top surface and the boiler, this heater extending down to the grate surface, where it is connected with the side heaters. By this construction, as will be seen, the fire is almost completely surrounded by water, in a manner designed to effect a

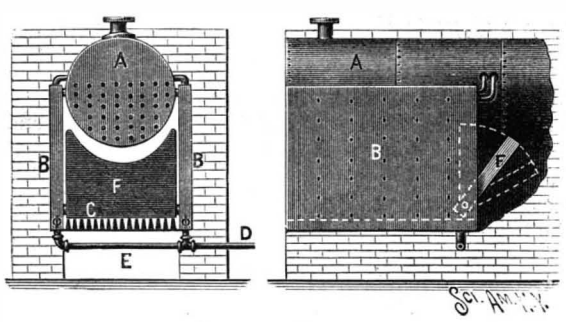


Fig. 2.

great saving of fuel. As the water will also be ordinarily at boiling heat when supplied to the boiler from the heaters, it is expected that the greater portion of the impurities and sediment will be deposited at the bottom of the heaters, where they can be conveniently removed by means of hand holes, and the boiler thus kept free from deposits of scale.

Compressed Air for Blast in Cupola Furnaces.

An important experiment for applying compressed air direct to a cupola furnace for the melting of iron for casting purposes was successfully carried out, according to *Ryland's Iron Trade Circular*, a few days ago, by the Birmingham Compressed Air Power Company. The experiment, which induced the attendance in Birmingham of nearly forty members of the South Staffordshire Institute of Civil Engineers, took place at the iron foundry of Messrs. J. Cartwright & Sons, in New Bond Street, and was superintended by Mr. Locock, resident engineer of the company. Hitherto the air has been applied to the cupola through an American patent blower. The air is now applied direct from the pipe through a jet resembling a steam jet. The volume of compressed air used carried with it nearly 150 times its own volume of free atmosphere. The admission and pressure of the air is easily and promptly regulated by the turning of a wheel which opens or closes the aperture through which the compressed air is admitted. Messrs. Cartwright, the makers of this air injector, state that in the melting of five tons of iron they saved one and a half hours in time, and they estimate that an economy of 40 to 50 per cent will be effected in the cost of the process of melting. By the application of the air direct to the furnaces, the engine, and, consequently, the engineer, are dispensed with, and the apparatus can be regulated by the man in charge of the cupola, the danger of accident from the use of steam boiler or of the machinery being avoided.

Sending a Soprano's Voice by Express.

The test of the powers of the phonograph recently given in the Grand Pacific Hotel, Chicago, was not novel save in the fact that the music, a soprano solo with piano accompaniment, was so accurately reproduced. Three weeks before, a well known New York soprano had given the song, a phonograph set up on a near-by table, listening to her, as one might say, with careful attention, so careful indeed that, when the instrument, sent on to Chicago by express, was set agoing, it was well nigh life-like, being, as we are informed, "only a few shades less perfect than when originally given." There was the high resonant treble, then the liquid vocals, the soft whisperings, as of zephyrs across summer seas; and each with its piano accompaniment, the strings being also so fairly true as to yet delight the ear, even though not at all times actually flawless.

Long ago it was prophesied that the voices of to-day would be "bottled" for future generations by means of the phonograph. But those who heard their own voices reproduced hoped the promise would not be realized for the wheeze and rasp of them. Perhaps the recent exhibition will reassure them.

AN IMPROVED POWER TREADLE ATTACHMENT.

An attachment affording a novel means for applying power to the ordinary form of treadle machine is illustrated herewith, as applied to a perforator, and has been patented by Mr. Eugene von Boeckmann, of Austin, Texas. Its frame is adapted to support the machine to be driven, the driving shaft being supported by bearings rigidly connected to the frame, and on this driving shaft are fixed parallel arms, between the outer ends of which a roller is mounted. The machine to be driven is mounted on the frame in such position that its treadle will be borne upon by the roller mounted between the parallel arms, as the driving shaft is revolved, each revolution of the shaft depressing the treadle. By moving the shaft to such position that its arms will be out of the way of the operator, the treadle may be depressed by the foot. Hooked bolts are provided for securely anchoring the frame to the floor, and one of the small views illustrates the manner in which the frame may be made fast to a masonry floor.

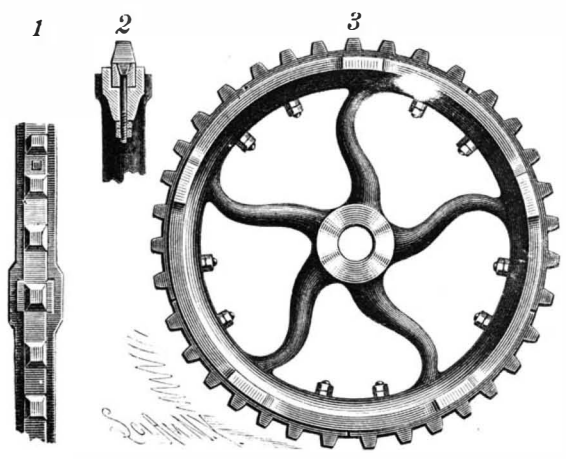
Boracic Acid as a Preservative.

Boracic acid only acts when present in large quantity. It prevents the growth and multiplication of germs, but does not kill them even in a 1 per cent solution. Experiments with milk gave very unsatisfactory results, as an addition of 4 per cent boracic acid only preserved the milk for four days. Horseflesh may be preserved for six weeks by the use of 3 per cent of the acid. Boracic acid is supposed to be harmless, but recent investigators, including the author, prove it to be dangerous, as it strongly acts upon the mucous membrane of the large intestine. A dose of 4 grammes killed a large rabbit, 2 grammes made a dog very sick.

The acid is much used in Sweden for preserving fish and milk, but cases of poisoning have already occurred in that country. Long continued use of the acid is not favorable to good health, and at all events its addition to milk should be prohibited.—*Emmerich, Chem. Zeitung, No. 76; L. De K., the Analyst.*

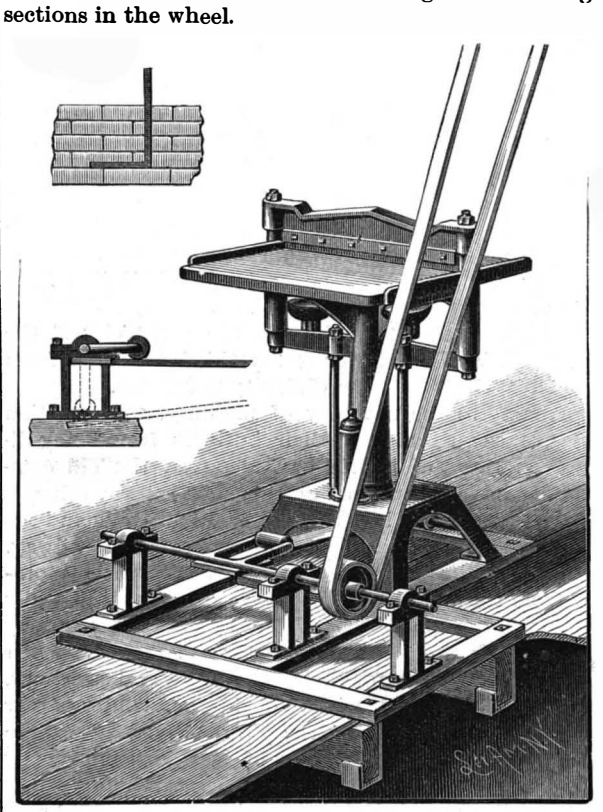
AN IMPROVED TOOTHED WHEEL.

A toothed wheel with detachable segmental sections, each carrying one or more teeth or sprockets, whereby a tooth or teeth may be simply and expeditiously removed from the body of a wheel when broken, is illustrated herewith, and has been patented by Mr. John T. Redington, of Ambler, Pa. The body of the wheel is formed in any well known manner, with a continuous groove in its periphery, and offset recesses at intervals intersecting the groove, these recesses being preferably located immediately above the spokes and extending



REDINGTON'S TOOTHED WHEEL.

into aligning offsets on the sides of the wheel, as shown in Figs. 1 and 2. A series of segmental blocks are inserted in the groove, the blocks carrying on their outer face one or more teeth or sprockets, each of the blocks having on its sides aligning lugs adapted to enter the recesses extending from the groove in the periphery, the lugs and recesses thus taking the main strain of the work from the fastening bolts, which project through the body of the wheel and are retained by lock nuts upon the inner face of the rim of the wheel. These bolts have essentially wedge-shaped heads, whereby they are prevented from turning when inserted in the wheel, and by simply withdrawing the bolts, one or more sections may be taken out and other sections substituted without disturbing the remaining sections in the wheel.



VON BOECKMANN'S POWER TREADLE ATTACHMENT.

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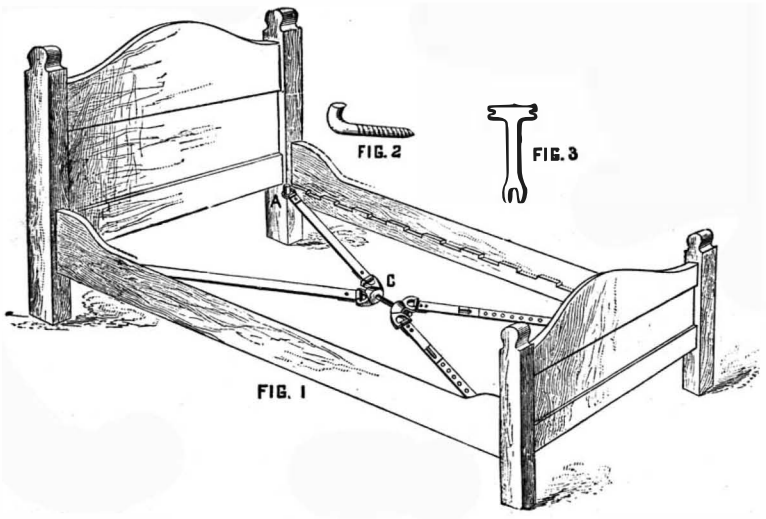
AN IMPROVED BRACE FOR BEDSTEADS.

A brace for strengthening bedsteads and holding the posts securely in place, and one readily applicable to old as well as new bedsteads, is illustrated herewith, and has been patented by Mr. Charles P. Lewis, of Sweet Springs, W. Va. The head and foot posts are each provided with a hook, A, on the inside, below the notched railing in which the slats are held, and to these hooks are attached the outer ends of bands fastened at their inner ends on the head, C, in which a threaded bolt is held to turn loosely, the bands being thus stretched and drawn very tight by means of a wrench. The bands are made adjustable, so as to fit



LEWIS' BED BRACE AND TIGHTENER.

the brace to bedsteads of different lengths, the two bands at one end having locking ferrules adapted to be locked by a pin fitting apertures in the bands. By this means the bedstead, besides being tightened in other ways, is made particularly rigid and strong laterally, and well braced against strains of moving.

THE NEW SPANISH STEAMER ALPHONSO XII.

The Alphonso XII. is a new ship, of which we give an engraving from *La Ilustracion Espanola*, lately built at Newcastle for the Transatlantic Company, of Spain. Her principal dimensions are: Length, 426 ft.; width, 48 ft.; depth, 33 ft.; draught, 24 ft.; displacement, 8,400 tons; indicated horse power, 5,000. She is one of the finest mercantile ships afloat—in fact, a veritable palace. As to interior decoration and furnishings, everything possible has been done for the comfort and entertainment of passengers. In the ornamentation there is a lavish use of marbles, bronzes, and costly woods. Taste and richness have been well combined. The most beautiful representations of the pictorial art, by notable living artists, adorn the interiors. Libraries of books, magazines, and newspapers attract the reader. Spacious, well ventilated cabins are provided. Baths, electric lights, abundance of life preserving apparatus, and every appliance for convenience and safety are supplied.

Our particular object in this article is to call attention to the rapid and successful manner in which Spain is building up and extending her foreign commerce, with the hope that our own countrymen may be encouraged to do something in the same direction. If there is one thing more than another that our people at present desire to see realized, it is the re-establishment, on a broad and permanent basis, of our foreign commerce. This can only be done through the medium of home-built steamships of such superior construction and speed that the flag of the Great Republic may be worthily displayed in all the principal ports of the world. Nothing is more easy of accomplishment, and yet our legislators, upon whom the matter depends, have done nothing but talk upon the subject for the past twenty years. If we want a share in foreign commerce, we must do as other nations are doing, as England, Germany, France, are doing, namely, grant liberal subsidies for the purpose. This has been the fixed policy of Great Britain ever since the commencement of ocean steam navigation, and, as a result, her steamers visit every quarter of the globe, and she enjoys the trade of the world. Within a few days past, subsidies to the extent of sixty-five thousand dollars a year for several years have been agreed upon for a line of steamers from Vancouver, the terminus of the Canadian Pacific Railway, to China and Japan, for twelve trips a year.

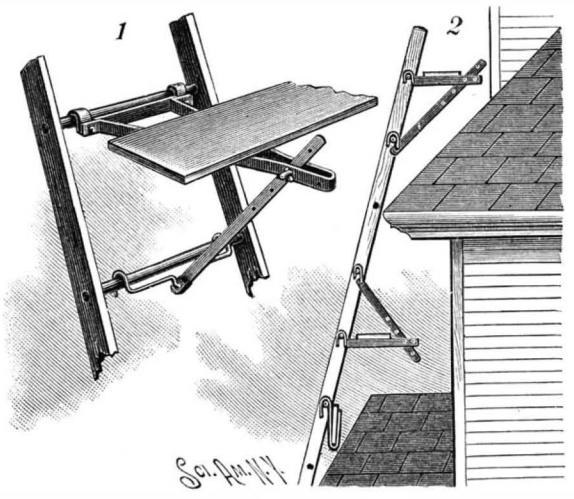
Within the past three years the Spanish government, by offering the stimulus of subsidies, has established several new lines of splendid steamers. Spain now has a noble lot of vessels plying between New York, Cuba, Mexico, and West Indian ports. On the Pacific she has a new line of steamships that regularly traverse the coasts of South and Central America. Her fleets of passenger ships sailing from her home ports to Cuba, to Manila, to Brazil, to the Argentine Confederation, and other parts, comprise some of the finest of vessels, and her commerce is rapidly growing in importance.

Electric Prostration.

Several cases of this new malady are reported from Creusot, France. It affects workers under electric light. The light exceeds 100,000 candle power, and it appears that it is this excess of light, and not the heat, which produces the nervous symptoms. A painful sensation in the throat, face, and temples is first noticed, then the skin becomes coppery red, and irritation is felt about the eyes, much lachrymation ensues, and these symptoms then disappear, while the skin peels off in five days. The effects are comparable to those produced by walking over fresh snow in the sunlight, and may be regarded as a sort of "sun-burning."—*Lancet.*

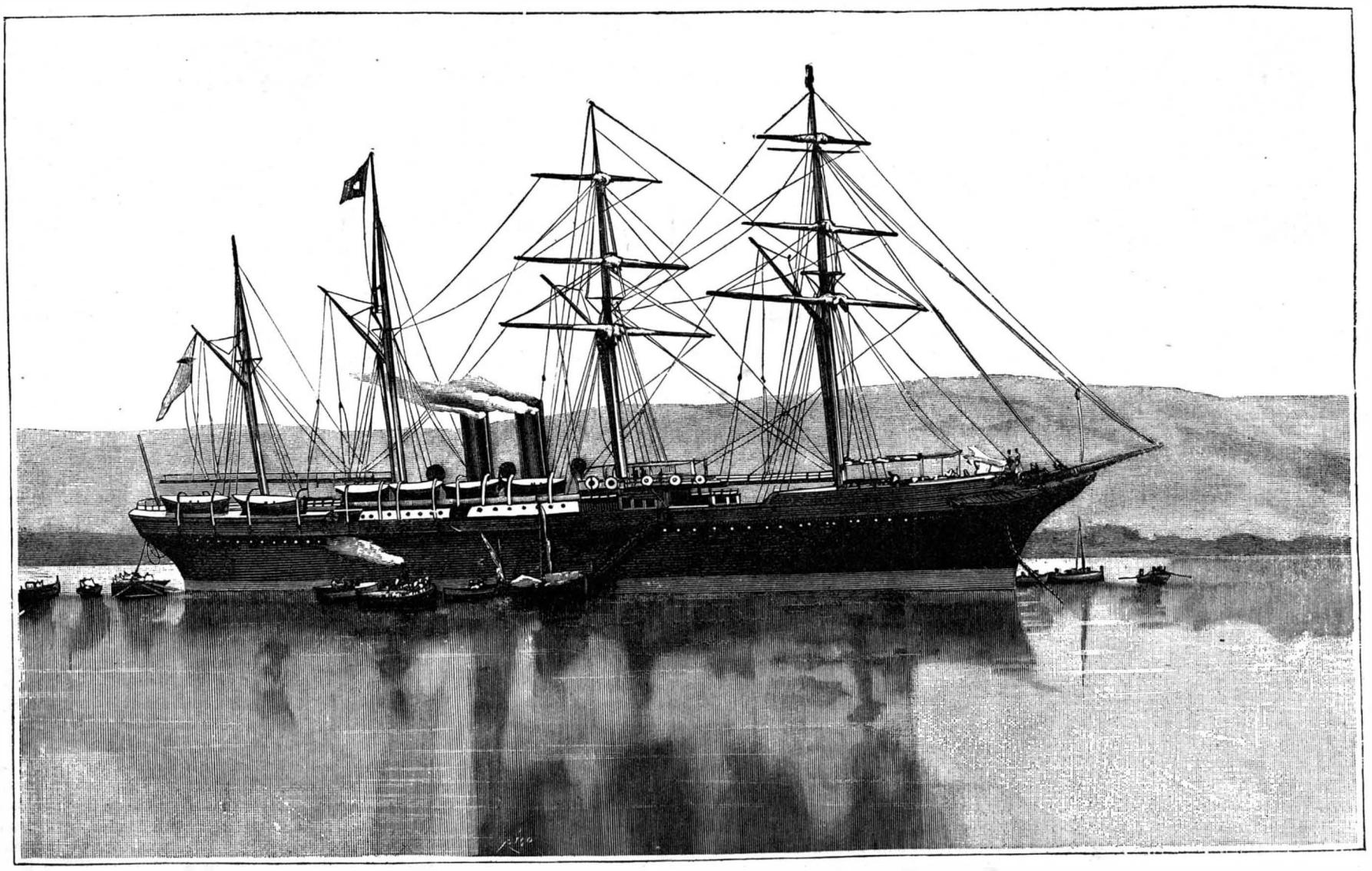
AN IMPROVED SCAFFOLD BRACKET.

A bracket which can be easily and quickly adjusted at any desired angle to a ladder, for supporting scaffolding, and one which is cheap and durable, is shown



LONG'S SCAFFOLD BRACKET

herewith, and has been patented by Mr. James A. Long, of Spokane Falls, Washington Ter. The horizontal brace for supporting the boards of the scaffold is made of flat iron, in an approximately V shape, as shown in Fig. 1, the free ends of the arms of the brace having offsets to which are secured iron hooks that partly encircle the rounds of the ladder. The outer portion of the horizontal brace has a space, outside the scaffold boards, for a running brace rod, both portions having perforations by which the brace rod may be locked by a bolt to the horizontal brace, the other end of the brace rod being adapted to engagement with a round of the ladder by means of a hooked clip. This bracket can be located at any part of the ladder, as may be required for working on different parts of a house, as shown in Fig. 2, the running brace being attached to the round above or below that engaged by the horizontal brace, as may be most convenient for the workmen. Double-hooked holders are provided to support the boards from the ladder while the brackets are being readjusted in changing the position of the scaffold.



THE NEW SPANISH PASSENGER STEAMER ALPHONSO XII.

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The Ingenuity of Smugglers.

A short time ago the customs authorities made a seizure of a considerable quantity of tobacco concealed in bales described as cotton waste, but in which cotton only played a secondary, although somewhat important, part so far as the smugglers were concerned. In another case a box supposed to contain fish was found to be lined with a much more valuable commodity in the shape of contraband tobacco; while, in the third instance, a sailor's accordion, although unwilling to discourse sweet music to the touch of a customs official, was, nevertheless, quite willing to disclose to his eager gaze its full contents of cigars. These are certainly very old dodges, but they lack the danger and excitement usually associated with the doings of the smuggler of the past, and which made that individual quite a recognized hero. Since the days of Ethelred, when customs duties were first levied, every conceivable device has been practiced in order to avoid payment of those duties, and, undoubtedly, so long as duties are imposed attempts will be made to defraud the revenue.

Toward the close of last century smuggling was very rife, and many a valuable cargo of contraband goods was successfully "run" and disposed of, realizing a handsome profit for the contrabandist. At that time, however, a far larger number of articles were taxed than at the present day (in fact, a hundred years ago no fewer than 1,425 articles were liable to duty), and this, of course, greatly increased the temptation to smuggle. Nowadays smuggling is almost exclusively confined to small quantities concealed on board our steamships, but even in effecting these concealments the smuggler exercises great cunning, and does his utmost to outwit the customs "rummager."

About a century ago it was no uncommon thing to find a vessel fitted with false bows or stern, a hollow keel, or with the spare masts, spars, and oars which she carried composed of tin, but painted to resemble wood, the cavities being utilized for the concealment of dutiable articles. Logs of timber were also hollowed out and employed for a similar purpose. Many a cask of spirits has been towed under the bottom of a vessel, a fear existing that a revenue cruiser might board the smuggler and discover the casks were they carried in the hold. When it was necessary to get them ashore they were weighted and kept under water, a mark being set as to their whereabouts, so that they could be taken away at a favorable opportunity. Another ingenious artifice, practiced on the East coast, was to cover casks of spirits with a kind of cement, and attach some seaweed thereto, which gave them the appearance of rocks, and then cast them on the bowlders ashore, from whence they were ultimately removed. Ships' carpenters have been known to smuggle spirits and tobacco in what passed for a pot of pitch, and a presumably studious individual, who frequently left his vessel with a book under his arm, carried in it a tin case containing spirits in order to avoid payment of duty.

Tobacco appears to have generally been the favorite object of the smuggler, and he still devotes his close attention to its importation. It has been frequently made up into ships' fenders or into cordage of all shapes and sizes, and brought ashore as such; while the wheels of some of the blocks in the running gear have been found to be made of Cavendish tobacco instead of iron. It has also been introduced into casks of pitch and casks of various kinds of seeds. False bottoms have been added to dog kennels, hen coops, drawers, chests, etc., in order to make these innocent-looking articles the receptacles of contraband goods. Tin cases, containing tobacco or cigars, have often been discovered in the water tanks and in the casks of spirits and oil carried by vessels. Wooden fenders hanging over a ship's side have been hollowed out and the cavity filled with tobacco. In many cases, too, it has been dropped between the outside plank and "skin" of a vessel, and concealed in water closets and other unsavory parts of the ship.

Bladders containing spirits have been secreted about the body, and tobacco and cigars have been brought ashore in like manner. Female smugglers had petticoats specially prepared for the introduction of tobacco, cigars, and spirits, the former being concealed in small pockets adapted to the purpose. When duties were levied on silks and lace, large quantities of these goods were imported without the cognizance of the customs authorities. These were the favorite articles of the female contrabandists; and by them many a package of costly silk and lace has been brought into the country. Vessels from France have been found attempting to import lace made up in boxes in the shape of apples, and so painted as to pass for fruit. Silks and lace were also frequently found in loaves of bread, and tobacco, on many occasions, has found its way into the same place of concealment, in fact, a large quantity so concealed was recently seized at Hull. When foreign watches were subjected to duty, many a gentleman's great coat has had for once a "silver lining," the smuggler attempting, by its assistance, to elude the vigilance of the customs officials. Snuff has been made into cakes and imported as oil cake, a considerable quantity being landed before the fraud was discovered.

On the abolition of the duties on coals, many of the colliers on the coast were engaged in the illicit trade. The *modus operandi* of these vessels was to obtain a part cargo at one of the coal ports, and, subsequently, at a point previously agreed upon, load a quantity of tobacco or spirits from a smuggler. Some of these vessels succeeded in making very profitable voyages in this manner.

An ingenious mode of concealment was disclosed in 1881, and a large seizure of contraband goods was the result. From "information received," the customs authorities sent a detective to Rotterdam, and he there discovered that boilers, evidently made for the purpose, and quite unfit for anything else, were being made the means of importing large quantities of tobacco into this country. Some time after arriving in England the boilers and smugglers were seized, and the latter mulcted in the penalty of £4,824. The tobacco seized on this occasion weighed five tons.—*Nautical Magazine.*

Steam Jet Phenomena.

Herr R. Von Helmholtz has sent to *Wiedemann's Annalen* some observations made by himself upon a jet of steam. He remarks that a jet of steam escaping from a hole of one or two millimeters diameter, lighted obliquely and observed upon a black background, is invisible at the lower extremity, and presents toward the top the well known whitish appearance. This aspect may be modified in many ways. If an electrified point is brought near the steam, the jet immediately becomes azure blue, or, according to the power of the electrical machine, purple, red, yellow, green, etc. These tints are intimately connected with the dimensions of the liquid drops, and hence it follows that the electrical point has the power of provoking condensation of the supersaturated vapor which is found at the lower part of the jet. The same result is obtained by bringing near to the steam jet a platinum wire made brightly incandescent by an electrical current, or silver, iron, copper, or brass wires simply made red hot in a flame, or even glass heated below the red, or an organic matter, wood, paper, etc., in a state of slow combustion. The products of any flame whatever, with the exception of the flame of pure alcohol, directed upon the jet of steam by the aid of a chimney or by simple blowing, produce a very energetic effect. Finally, traces of certain chemical substances introduced into the steam jet cause the same modification. Among these are hydrochloric and nitric acid, but concentrated sulphuric acid especially shows the phenomenon. It is known that solid dust particles provoke the condensation of supersaturated vapors, but their presence cannot be invoked here to explain the preceding facts.

The author is of opinion that they may be attributed to a molecular concussion, the effect of which may be compared to that of mechanical concussion upon superheated or supersaturated liquids. A flame, for example, is the scene of closely approximated and extremely varied movements, and the chemical atoms which are incessantly passing in it from one combination to another are found in every kind of unstable condition. These movements and changeful states of equilibrium leave their traces in the products of combustion at a certain distance from the flame properly so called, and determine the observed phenomena. The luminous effect produced at the extremity of an electrified point and the presence of ozone in its vicinity show that this point is the cause of concussions comparable to those provoked by active combustion, and the analogy between the two phenomena is found again in the fact that they both furnish means for making electricity pass through gas. As to solid incandescent bodies, they can act either through the emission of solid particles from their surfaces or by the chemical concussions which they communicate to the surrounding gases.

The Cost of Electric Street Lighting.

The following figures of the charges for lighting streets with arc lamps are of interest. They have been quoted from a communication of the Boston Citizens' Association, which was addressed to the Board of Aldermen of that city for the purpose of showing that Boston is overcharged for this service. For New York, the average price is given as 34⅓ cents per lamp for one night's service. Brooklyn pays 55 cents, Buffalo 45 cents, New Orleans 34 cents, Philadelphia 50 cents (average), and Baltimore 50 cents. Boston pays 65 cents. The Citizens' Association of Boston claim that on the 695 lights used in their city the reduction in cost of carbons from the figures of 1882 represents 25 cents per lamp for each night, an aggregate of about $60,000 per annum. The price of carbons in the last six years has fallen to less than one-third the original price. Yet Boston is now paying the same rate paid in 1882—65 cents per lamp. In 1887 the service cost $131,097.97. All of this, except $11,299.54, was received by one company. It seems very clear that Boston needs a little healthful competition. It is interesting to notice how important a factor carbons are in the cost of electric arc lamps. It seems like hoping for an impossibility to think of indestructible electrodes being possible, yet until some advance in that direction shall have been made, the electric light will be far from perfect.

The Inventors' Institute, London.

The present session of the Inventors' Institute was opened on October 24, when Admiral Selwyn, vice-president, delivered an address on subjects of importance in relation to the patent laws. The general union of inventors had been, he said, for many years persistently sought by the council in spite of many difficulties. How far the interests of inventors will be affected by the changes the patent agents are seeking to establish, it will be the business of the council to investigate. That there should be a registration of patent agents no one doubts, and that measures should be taken to punish those who behave badly is reasonable enough. It requires merely that the punishment should be defined by the state. What inventors want, and what would instantly benefit the state, is a simplification of the law, a reduction of the fees, an extension of time, and, above all, security of title for patents. So strongly is this latter requirement felt to be essential in the United States that there have been during the present year several cases decided by the Supreme Court in which the infringers have been held liable not only for the damages claimed by the patentee, but also for the mesne profits made during the whole period of infringement. It has also been decided that, even when no patent has been taken, but the invention has been worked, there is a proprietary right, and that those who obtain the secret by corrupting workmen or otherwise fraudulently are liable to an action for damages. This is the consecration of a principle asserted at the congress of Paris in 1878, in the following language: "The right of inventors in their works is a right of property. The civil law does not create it, but only regulates it." The United States have been the first to see its justice and policy.

As an instance of the serious detriments which may accrue to a state from unwillingness or incapacity to examine into and appreciate the value of inventions, the vice-president referred to the case, recently become publicly known, of Mr. Longridge, who, in 1855, demonstrated mathematically the value of wire in the construction of artillery, as a means of making a strong gun cheaply and quickly. In 1860 he made such a gun; but still in 1875 he was told that his proposals had been carefully examined, but that they were not applicable to Her Majesty's service. In the present year (1888) General Maitland has publicly stated that a gun has been made at Woolwich on Mr. Longridge's plan which has distanced all competitors, and thrown a shot 12½ miles at an initial velocity of 2,300 feet per second. We may assume, therefore, as some £5,000,000 has been annually spent during the past thirty-three years on guns, forts, powder, and armored ships, that £175,000,000 expenditure has been rendered nugatory by this suppression or ignoring of an invention. The sole consolation to be found in this case is that the expenditure has taken place in our own country. It will also be seen that in this case there is evidence of the insufficiency of time during which in England a patent is sustained.

The present year bids fair to eclipse its predecessors in the number of patents applied for, there being 14,500 to date. In fixing the taxes on patents, the legislator seems to have lost sight of the fact, so often insisted on here, that income is created by every successful invention, and that such income then pays taxes far in excess of the amount the inventor is called upon to pay as fees. The philanthropist seeks to remedy poverty by taxing the rich, forgetful that the rich are the best employers and paymasters of the poor. The visionary advocates division of riches; but the mission of the inventor is to increase wealth in proportion as his inventions provide honest labor with profitable wages. That no inventor may imagine there is neglect or idleness in this Institute, Admiral Selwyn remarked that it had urged the views entertained by the council on the committee of the Board of Trade by personal attendances during the present year, but as only one question had been officially brought forward, namely, the practice and organization of the Patent Office, there has been no opportunity of urging so much as they would have wished. The true remedy for the evils still existing in the patent law, and in the practices of the courts, agents, and offices, is the simplification of the law. Nothing but the strictest union among inventors can move members of Parliament to assist our united action. In conclusion, the Admiral explained the advantages which the American law offers to the citizens of other countries for taking out in the United States the first patents for their inventions.

Preservation of Meat.

The *Journal d'Agriculture* states that it is customary in Upper Saone (France), both on farms and in villages, to preserve meat in summer by placing it in large earthen pans or pots filled with curdled milk, or even with skimmed milk, which soon curdles, and storing the vessels in the cellar. In order to keep the meat beneath the surface of the milk, it is loaded with clean stones. Meat is preserved in this way for over a week, without the least change in its flavor. When it is needed for use, it is simply washed and dried. The milk is fed to swine.

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The Confederate Cruiser Shenandoah.

The way the British assisted the Confederates during the late war of the rebellion is thus briefly described by the London *Engineer*. Referring to the naval exhibits now in the Glasgow exhibition, our contemporary says:

The Clyde, in 1860, was the first iron ship built for Messrs. Somes Bros., of London, whose East India fleet is well remembered as perhaps the most notable of that time.

Next to the John Lidgett, already referred to, was a model of a vessel which recalls the stirring maritime events of the American civil war. The vessel it represents, which was built in 1863, was at first named the Sea King. She was of composite construction, ship rigged, and fitted with auxiliary engines, a telescopic funnel, and a lifting propeller, being designed for the China trade, in which she quickly won her spurs as a swift tea clipper. This excellent quality attracted the attention of the Confederate government, who bought her and fitted her out as a cruiser, naming her the Shenandoah, under which designation she became a terror to the Federal mercantile shipping. Moving about as an apparently harmless and innocent sailing ship, she would suddenly raise her telescope funnel, and, putting on steam, would rush upon her prey, and after destruction or capture, would again resume the guise of a sailing ship and proceed in search of further prizes. The civil war had been nine months at an end when her commander, Captain Waddell, first heard from an English vessel that peace had been concluded. Most of his crew then begged of him to run his ship ashore and let each man look out for himself; but this the captain refused to do. Instead thereof, he set sail for this country, and running the gauntlet of the United States navy for a distance of 20,000 miles, he arrived safely at Liverpool, where he surrendered to the Queen of England. The Shenandoah was afterward purchased by the Sultan of Zanzibar, who made her his yacht, and ultimately, we believe, her checkered career was closed by being wrecked on the African coast. It may be of interest to note that the dimensions of this remarkable vessel were 222 feet long, 32 feet 8 inches broad, and 20 feet 6 inches deep. Her gross tonnage was 1,018, and her engines were of 200 nominal horse power.

Curious Chinese Notions.

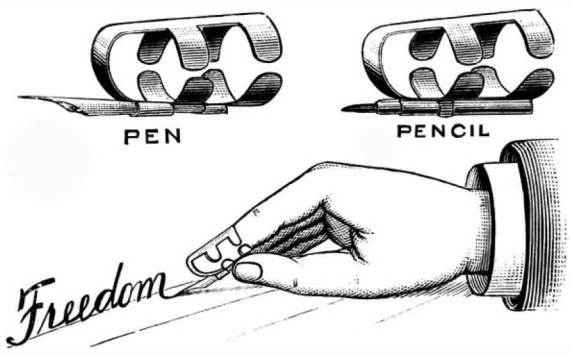
Both savage and semi-barbarous people have always exhibited a great repugnance to any surgical operation, however necessary, which involves amputation. The *North China Herald*, in commenting upon this circumstance, points out that the Chinese have always shown this repugnance, not on account of fear or pain, for they are patient under all kinds of physical suffering, but because they look upon it as a duty to keep the body intact. If they submit to the amputation of a limb, they invariably ask for the severed member, and keep it in a box, to be buried in due time with the owner. Sometimes they will actually eat it, thinking it only right that that which has been taken from the body should be returned to it. On the same principle, an extracted tooth will be carefully preserved, or ground to powder and swallowed in water. Another curious phase of the same idea is seen in the belief that a sick parent can be cured by broth made from flesh cut from a living child, and it is looked upon as a sign of filial piety for the child to submit himself to an operation for that purpose. The child is supposed to be of the vital essence of the parent, and if a portion of this essence is returned to the fountain-head, the parent will be greatly strengthened. The peace-loving nature of the Chinese is said to be largely due to this respect for the human body.—*Chambers's Journal.*

A Model Kitchen.

It is possible nowadays, says an authority, by spending money lavishly, so to build a kitchen that the most ingenious of servants cannot keep it otherwise than clean. One need not waste upon her unappreciative soul the costly tiles with which one lines the bath room, but may substitute for them the glazed bricks that are as highly polished, and that will make the floor, the chimney, the walls, if desired, and even the ceiling, as easy to clean as a breakfast plate. Once built, no whitewasher and no painter would be needed for such a room, no smoke need cling to its walls for an instant, and no odor of cooking would be perceptible in it, even if it were used for generations. And the temperature of such a room need not reach the great height unavoidable with plastered walls, which permit the warmth of the chimney to be perceptible through their surface, and thus both the good health and the good temper of the cook would be maintained. As for coloring, such a kitchen may be precisely what one pleases, for the bricks are made in all hues, and they may be laid in patterns or in wide surfaces of one tint from floor to ceiling. Lastly, as such a room would be fireproof, a sliding or swinging iron door would so isolate it that no kerosene-quickened fire and no careless upsetting of lard could bring destruction to the room itself of which a little water would not clear it.

FORSTER'S FINGER PEN AND PENCIL HOLDER.

This finger pen holder does away with the use of a pen handle, the finger itself performing this function. The holder slips over the end of the finger, and the springs hold it firmly in position for writing. The holder is stamped out of spring brass, German silver, silver, or gold. It will fit any finger without causing any inconvenience to the user, and when writing is interrupted it is not necessary to lay it down, but it may be worn until there is no longer any use for it. Any style of pen can be used, and it may be carried in a small box in the vest pocket. By supplying it with



FORSTER'S FINGER PEN AND PENCIL HOLDER.

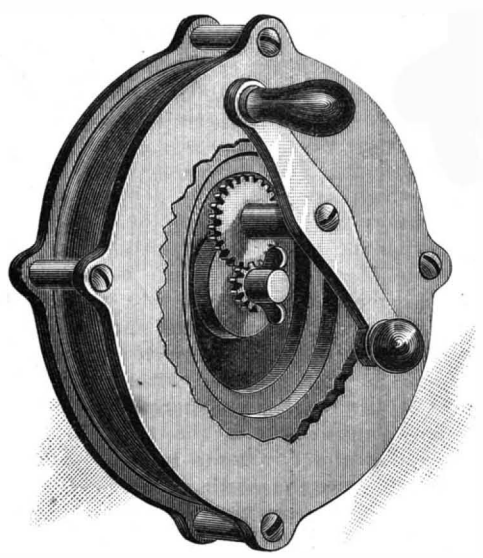
an ink tube, it may be used as a fountain pen. This is the invention of Edward E. Forster, 348 East 87th Street, New York.

Damping Grain.

One of the largest millers in the United States, C. A. Pillsbury, is credited with asserting that American millers do not dampen their wheat before grinding it. This is correct of some millers, but not of all, and the reason is not attributable to differences in millers, but to differences in wheat. Most of the California wheat ground in this State is moistened, because it is found necessary to do so. On the other hand, Oregon wheat will not stand dampening, as it contains enough water without this treatment. On this account local millers prefer California wheat, as they can add the necessary water for nothing, which they have to pay for in the Oregon article. When shipped abroad or stored for months at tidewater, there is less difference, as wheat which is not moist will become so when in a damp atmosphere. California wheat when afloat gains two to three per cent from absorption of moisture. A certain percentage of water in wheat is essential to render it fit for grinding, and the moisture has to be either found in the grain or applied artificially thereto.—*San Francisco Grocer.*

AN IMPROVED FISHING REEL.

A simple and durable reel, by which the line can be easily wound up or unwound, or locked in place as desired, is shown herewith, and has been patented by Mr. Nikolaus Dilg, of No. 631 East Fourteenth Street, New York City. The outer ends of the flanges of the reel proper fit in recesses on the inside of the side plates, whereby the line is permitted to run freely without getting entangled. The reel has a central transverse shaft on which loosely fits a bushing, a pinion being formed on the outer end of the bushing to mesh into a loosely turning gear wheel, the hub of



DILG'S FISHING REEL.

which extends through the outer side plate, and carries on its outer end the reel handle. The shaft serving as the axis of the reel also projects through the outer plate, where it is screw-threaded and provided with a winged nut, adapted to screw against the face of the pinion on the bushing surrounding the shaft. By screwing this winged nut inward against the face of the pinion, the reel is pressed tightly against the inner side plate, and a rapid unwinding or winding up of the line is prevented. Our view represents the outer side plate partly broken away, all of the gearing being inside of the side plates out of sight, preventing the gear wheels from being clogged up.

How the Mare Island Navy Yard was Lighted with Gas.

Mr. J. R. Smedberg says: In 1878 I was employed to connect the mains of the Vallejo, Cal., Gas Company with the government gas holder in the Mare Island Navy Yard, the impediment being a tidal strait some 1,400 feet wide and thirty feet deep. The fee was a fair one, but conditioned upon the success of the work.

At the end of the Georgia Street wharf, on the Vallejo side, I placed an Otto engine, a piston gas pump, and a tension cylinder, with quick-motion gates to act like a fitter's pump in blowing out any water condensed from the gas in the droop of the traversing pipe. The inlet to the gas engine was, of course, provided with a little gas holder to insure regularity of explosion.

The next task was to get a two-inch galvanized wrought iron wire across the strait. A series of barges were moored, and the pipe jointed on them ready for lowering, but some tipsy sailors found an obstacle in the way of their evening expedition, and cut the mooring ropes, so that the whole flotilla swung with the tide and twisted the pipe almost into a knot.

We then decided, on the hint of Mr. Fagan, the Vallejo company's superintendent, to place a capstan on the Mare Island side and pull the pipe across by sheer strength. So this was done, with a beveled chair under the leading end of the pipe, and a buoy tied to it in case of accident, coupling on length after length from the Vallejo wharf. The completed pipe lay like a hollow rope on the bottom of the strait, was connected at both ends, the engine and pump were started, and the Navy Yard was, for the first time, lighted with coal gas, instead of gasoline.

Then it was the unexpected which happened, or rather the expected which did not happen. During three years the pipe was never trapped off; there was no condensation of water vapor in 1,400 feet of pipe laid in water, with a drop of thirty feet in the center; the tension cylinder was never used.

It occurs that the gas may have left the pump under so high a temperature, due to compression, as to retain its carrying power of the vapor through the long conduit because the linear velocity through that conduit was so high, in other words, that a larger pipe would infallibly have been trapped. The friction developed by high velocity against the interior surface of so small a tube must also have tended to keep up the temperature of the gas flow. The gas left the pump at 100° Fahrenheit, and went across at the rate of 2,250 cubic feet per hour. The linear velocity was therefore nearly twenty miles per hour, and the time of transit about fifty seconds.

Yellow Fever.

Dr. G. M. Sternberg, who was commissioned by the College of Physicians, of Philadelphia, to investigate the methods of protective inoculation as practiced in Brazil (by Dr. Domingos Freire) and in Mexico (by Dr. Cargona y Valle), reported that facts concerning the endemic and epidemic prevalence of the fever justify the belief that its cause is a micro-organism, which can, under suitable conditions, be propagated outside the body, as well as be capable of transport to a distance; also that, as a single attack of yellow fever, however mild, mostly protects from future attacks, there is reason to hope that such protection might be gained by inoculation. The yellow fever germ probably gains entrance into the body by the respiratory or alimentary tracts, or through the surface of the body, or it is possible that it multiplies in insanitary localities and develops a volatile poison which contaminates the air. The former hypothesis, that it enters the body and multiplies within it, is, he thinks, the more probable. Hitherto the germ has not been found in the blood and tissues of those attacked, for Dr. Sternberg does not confirm the alleged discovery made by Dr. Domingos Freire. Nor is there, in Dr. Sternberg's opinion, any satisfactory evidence that the method of inoculation practiced by Dr. Domingos Freire has any prophylactic value, and the same applies to the claims put forward by Dr. Carmona y Valle, of Mexico.—*Lancet.*

MR. W. CROOKES, F.R.S., has presented to the department of science and art a collection of sixty-eight radiometers and similar instruments for permanent exhibition in the science galleries of the South Kensington Museum. They illustrate the steps by which Mr. Crookes was led to the construction of the radiometer, and to the production of motion and of phosphorescence by streams of electrified molecules in high vacua Many of the instruments are of the greatest historical interest. Among them is included the first radiometer, with many others which are described in Mr. Crookes' papers in the Philosophical Transactions of the Royal Society. Others are of considerable value, as they contain collections of diamonds, rubies, etc., for the exhibition of the phenomena of phosphorescence. Nearly all are in working order, and will be of great use in illustrating lectures to students in the Normal School of Science at South Kensington.

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THE REMINGTON TYPEWRITER.

With almost periodic regularity there appear from time to time great inventions which form the bases of new industries, or greatly modify those already existing. They often affect wide ranges of business interests, frequently producing marked changes in the manners and customs of the people. Such inventions were the steam engine, the reaper, the sewing machine, telegraph, telephone, and dynamo.

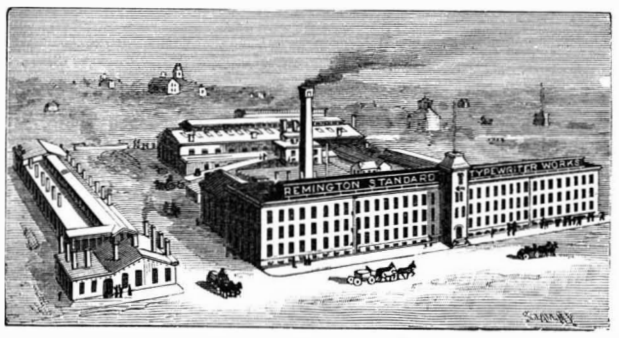

Fig. 4.—THE WORKS.

Another invention, none the less deserving of a high position among important modern inventions, is the typewriter. Its earlier development, like that of the steam engine and many other leading inventions, was not rapid, but by gradual improvement it has been perfected to a high degree, both in principle and construction.

The machinery required in its manufacture, as well as the system by which the parts are made, inspected, and assembled to form a perfect machine, are the necessary concomitants of a new invention, and altogether form a new industry, employing a small army of the best of our mechanics. The extent of the typewriter business is little known outside of those immediately interested in its manufacture or sale. More than 1,500 machines are turned out monthly at the works which we now illustrate. This looks like a large number, but we venture to say that it will soon be doubled and perhaps trebled.

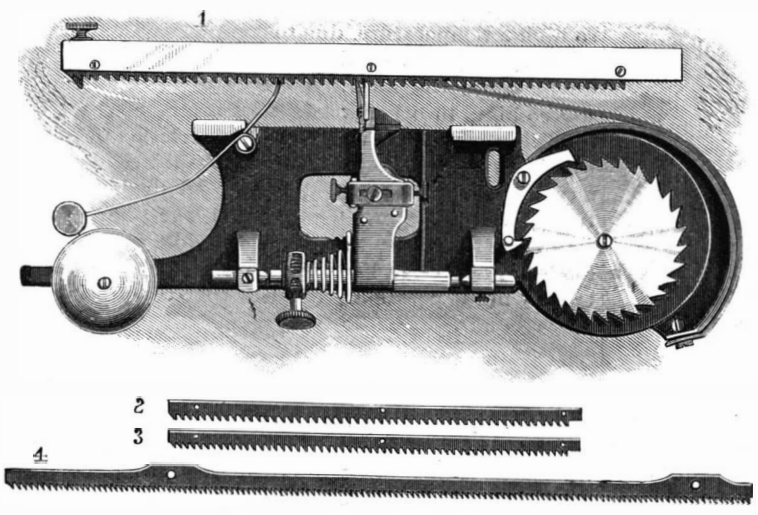

Fig. 9.—FEED MECHANISM.

The typewriter is becoming as indispensable in business and for private use as is the sewing machine in manufacturing and domestic uses. The advantages gained by the employment of the typewriter are so numerous and so important as to excite wonder as to why the machine was not invented and perfected centuries ago, instead of being one of the most recent products of inventive genius. Among these advantages the foremost is, perhaps, that of accuracy. There is no cover of crooked lines and ink blotches under which to conceal poor spelling and bad punctuation. Every character is positive. It stands for itself and cannot be mistaken for anything else. Another advantage, which is no less important than that of accuracy, is that of rapidity. It needs no argument to prove that 1 is less than 4 or 7. Every character made by the typewriter is the result of a single stroke of the finger, whereas the simplest written characters require several movements.

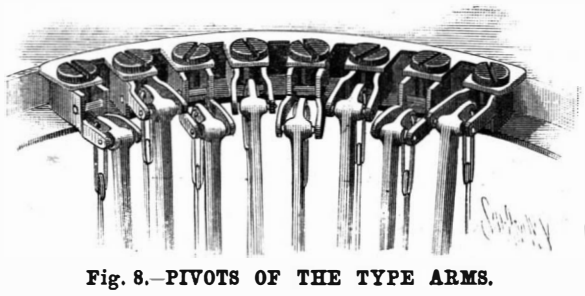

Fig. 8.—PIVOTS OF THE TYPE ARMS.

Another advantage is the facility of learning to write. In ordinary hand writing the student may be correct in spelling and in the use of capitals, and accurate in punctuation, yet never be able with any amount of practice to produce a legible or presentable manuscript. With the typewriter, all rules for the formation of letters and characters may be ignored, and all of the toilsome practice required to produce a copyist's hand may be avoided.

Still another advantage is that of producing manuscript in duplicate. It is often of great importance to provide exact copies; nothing is easier than to accomplish this by means of the typewriter. From four to twenty legible impressions which are exact duplicates may be made simultaneously.

It is about as difficult to tell who invented the typewriter as to name the inventors of the locomotive. The typewriter in its present state is the result of the efforts of many inventors. The fundamental invention which underlies the construction of the type writer most largely in use was due to Mr. A. E. Beach, one of the proprietors of this journal. The principal feature of his invention was the arrangement of the radial swinging arms, carrying at their free ends the types for producing the impressions. Mr. C. Lathom Sholes, of Milwaukee, was the principal inventor of the first Remington typewriter. We cannot enter into the detail of all the improvements that have been made in the typewriter, but will point out in a general way the main features of construction and describe briefly the manufacture of the Remington typewriter, which has been so successfully perfected and introduced under the management of the well known firm of Wyckoff, Seamans & Benedict, of 327 Broadway, New York.

The Remington typewriter, formerly made by E. Remington & Sons at Ilion, New York, is now made at the same place by the Remington Standard Typewriter Manufacturing Company, a company organized by Messrs. Wyckoff, Seamans & Benedict and others some two and a half years ago, and by whom, at that time, the business, machinery, tools, and franchises of the typewriter were purchased from the Messrs. Remington.

One of our engravings presents a bird's eye view of the Remington works; the other views show the construction of the machine and several of the operations concerned in its manufacture.

Fig. 5 is a vertical transverse section of the No. 3 machine, showing the arrangement of the keys, key levers, and connections. In the upper part of the main frame of the machine is arranged a ring to which are clamped loops in which are pivoted the type arms. These loops are arranged in two series, one above the other, to economize space. There are in these machines as ordinarily constructed from 38 to 42 of these type arms, each one bearing at its free extremity a die having on its face two characters, generally an upper and a lower case type, but some of them bear other characters; for example, figures and punctuation marks. The type arms are pivoted relative to the ring so that the characters which they bear all strike exactly in the same place. The type arms have hardened steel pivots which are ground to a bearing, thereby insuring accuracy in the movement of the levers, and at the same time increasing their durability.

As shown in Fig. 5, each type arm is connected by an adjustable steel wire connector with the key lever pivoted at the back of the machine and projecting beyond the front, where it is curved upwardly and provided with a finger piece or key bearing the character or characters represented by the type arm with which the key lever is connected. By using two characters on each type arm, and by a very ingenious arrangement of the paper carriage, the necessity for separate keys for capitals and small letters is avoided, one key being made to serve for two letters or characters.

The mechanism by which this is effected is shown in Fig. 6. The paper-supporting roller is journaled in a frame which is capable of moving transversely on the paper carriage the distance required to shift the paper from the lower case letter to the capital upon the type arm. The end of the type arm and the double type carried thereby is shown in detail at A, and the paper-supporting roller, B, is shown in full lines above the lower case type, and in dotted lines in its position for writing capitals. The capitalizing key, C, which is the foremost one shown in this view, is connected with a right-angled lever, D, through which lateral motion is imparted to the carriage. A spring connected with the lever, D, returns the roller to its normal position as soon as the finger is removed from the capitalizing key.

In this view (Fig. 6) is also shown the feeding and spacing mechanism. The space bar, E, extends entirely across the front of the key board, and a bar, F, which is supported by rods, G, from levers, H, extends under all of the key levers, including the levers attached to the space bar. The levers, H, support the ratchet bar, I, which acts upon the pallets, *a*, *b*, in alternation, allowing the spring attached to the paper carriage to move forward one space at a time, as the pallets, *a*, *b*, escape from the teeth of the ratchet bar, I.

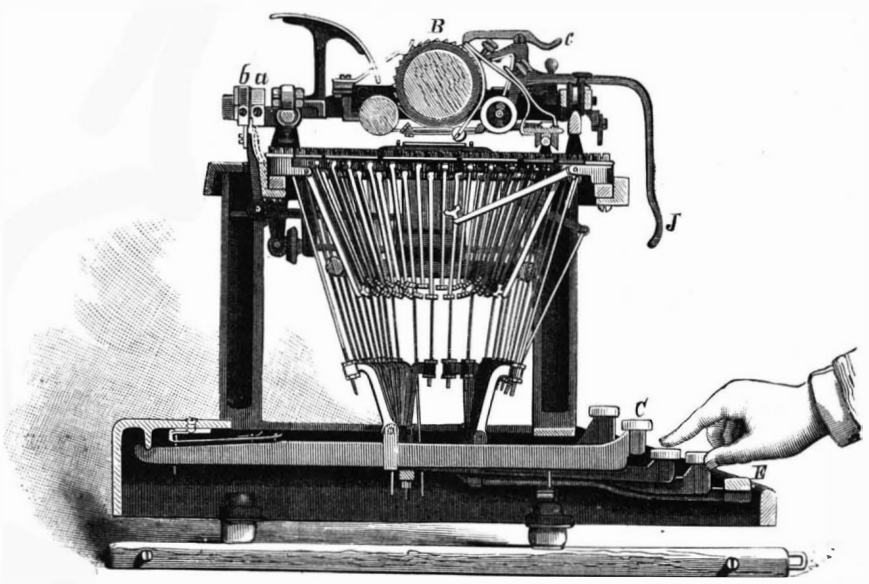

Fig. 5.—TRANSVERSE SECTION OF THE TYPEWRITER.

It will be observed that whenever a key is depressed to print a character upon the paper carried by the roller, B, the bar, F, will be moved down and the rack bar, I, shifted from the pallet, *b*, to the pallet, *a*. This is done without any movement of the carriage; but when the key is released and the rack bar, I, returns to its position on the pallet, *b*, it allows the paper carriage to move forward one notch. If a greater space is desired than the normal action of the machine provides, the space bar, E, is touched immediately after printing the character, and if a space is required without writing, the space bar, E, alone is operated.

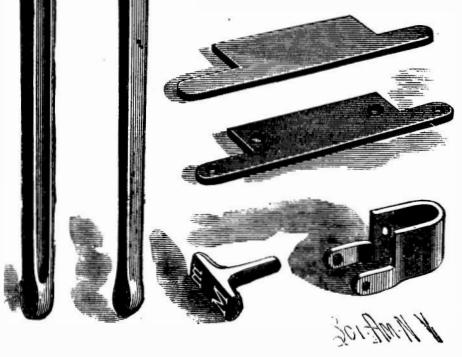

Fig. 7.—TYPE ARMS AND TYPE.

In the No. 3 machine for wide paper, which is the machine selected for our illustrations, the paper carriage moves freely, being supported by three rollers.

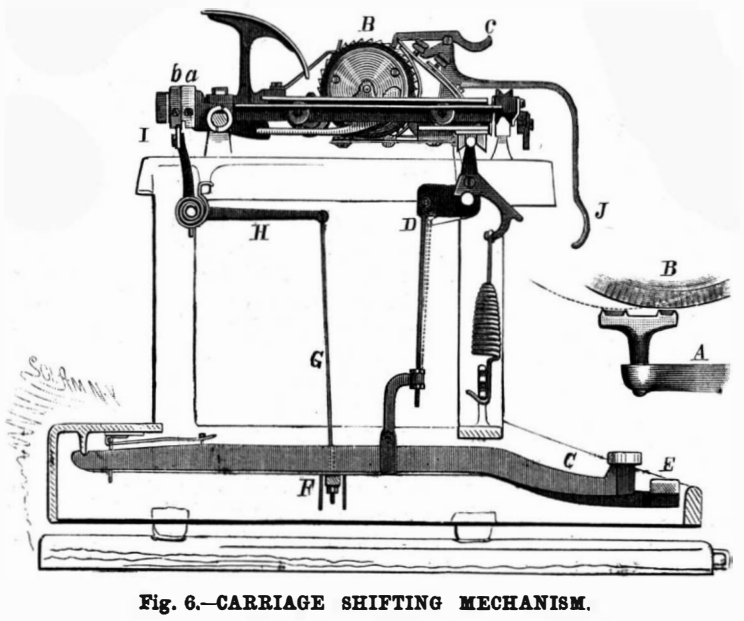

Fig. 6.—CARRIAGE SHIFTING MECHANISM.

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two running on a cylindrical rod at the back of the machine and the third one running on a V-shaped track at the front of the machine. The carriage may be readily lifted to inspect the work by means of a carriage handle extending over the frame of the machine at the left, above the key board. When the carriage is returned to write a new line, the raising of the lever, J, brings the pawl, *c*, into engagement with the ratchet on the roller, B, thereby moving the paper carried by the roller forward a distance equal to the space between the letters. The carriage is provided with a simple adjustment, by means of which the space may be varied according to the requirements of the work.

In Fig. 10 is illustrated the operation of centering the type arms. An arm carrying a pin corresponding in form to the shank of the double type is supported above the ring carrying the type arms, the pin being located exactly in the center of the ring. Each lever is adjusted so that the aperture in its free extremity which receives the double type fits upon the pin. The types are adjusted in the ends of the arms in a similar way.

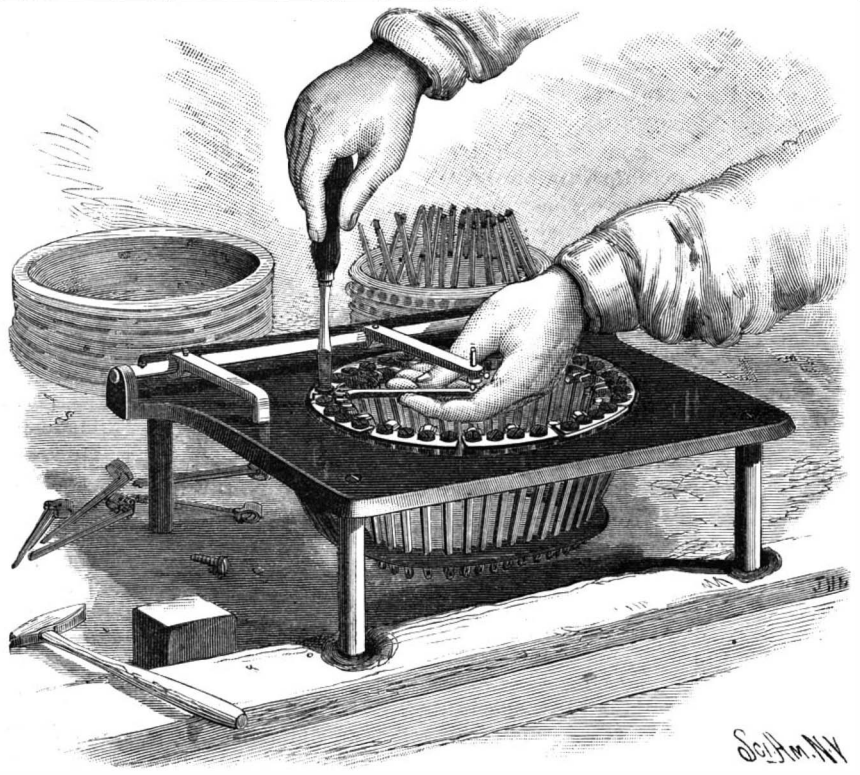


Fig. 10.—CENTERING THE TYPE ARMS.

In Fig. 1 is represented the department in which the dies for making the steel types are designed and made. Great skill and much patient labor is required in the making of these dies, but when once made they are capable of producing a large number of types. Types are here formed for nearly every written language. For the Chinese no type writer has been constructed. As thirty thousand characters are employed in expressing this language, it is obviously impossible to adapt the type writer to such a large number of characters.

In Fig. 3 is shown the department for tempering, annealing, and bluing. The types used in the type writer are made of steel, tempered and hardened like wood- or iron-working tools. The workman takes a quantity of types, heats them to the proper temperature, and plunges them into a vat containing a mixture capable of giving them the required degree of hardness. To facilitate the operation of separating the types from the mixture contained in the vat, the vat is composed of an inner and outer portion, the inner portion being a sieve of sufficient fineness to retain the types while allowing the mixture to flow out as the sieve is raised.

Adjoining the type-hardening fire is the bluing furnace, in which the steel parts not otherwise protected against oxidation are blued. This operation is performed with unformity and great rapidity by placing the screws and small parts in sand, and heating the whole until the required color appears, the sand bath being agitated to cause the heat to be uniformly distributed over the contents of the heating vessel. When the bluing operation is completed, the screws and other small parts together with the sand are emptied into a sieve which allows the sand to pass through while it retains the steel parts.

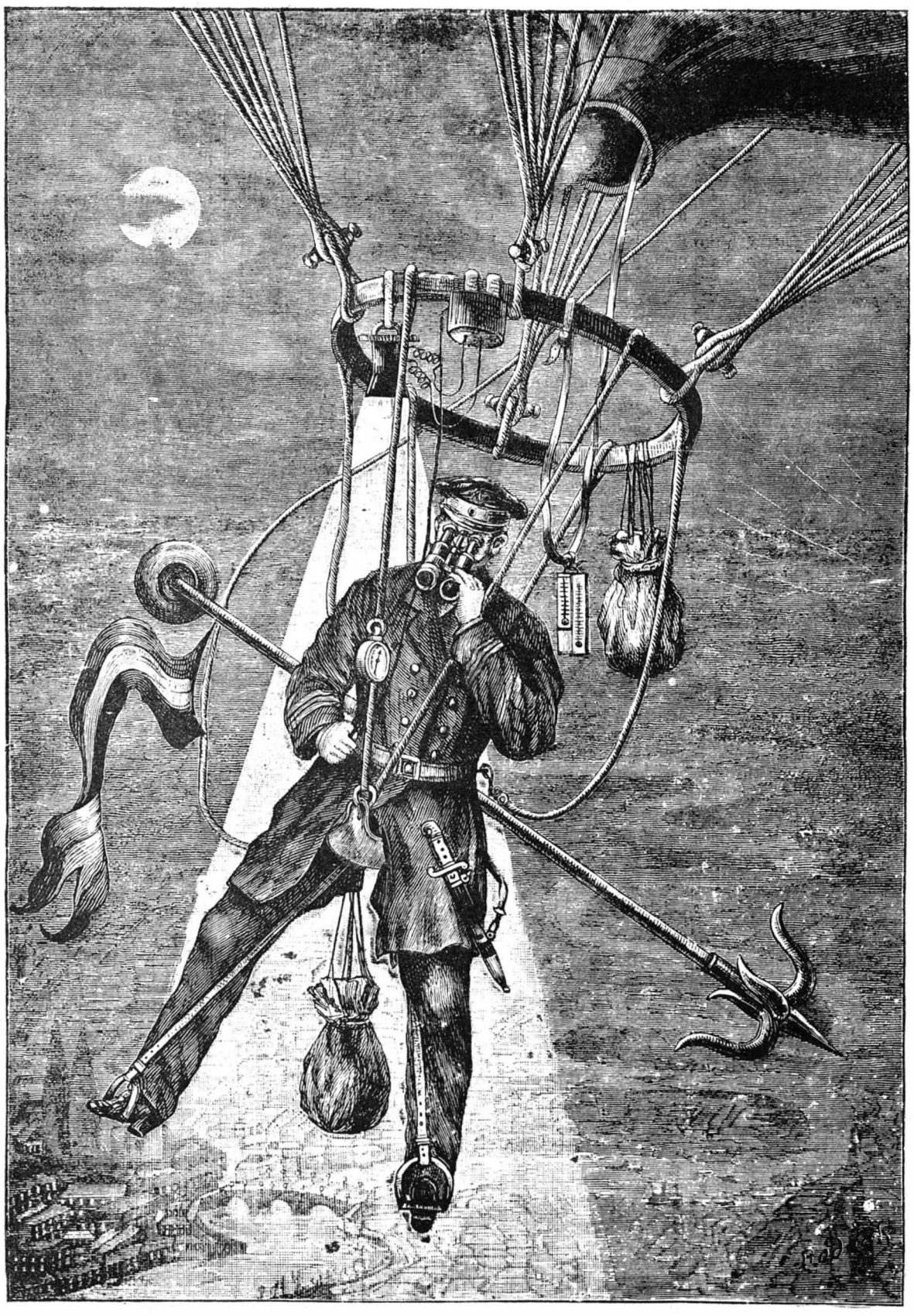
Adjoining the bluing furnace is the annealing furnace, where the types and other steel parts are softened preparatory to forcing them into dies which give them their form, before hardening.

In Fig. 2 is shown a machine in which the covers for protecting the machines are formed. In this ingenious machine the covers are quickly formed from sheet metal.

In addition to the various operations which we have briefly described, there are necessarily many others which go toward the completion of the machine; for example, many of the parts are nickel plated, others are japanned and nicely ornamented; many of the parts are drop-forged. The key levers are of wood ingeniously re-enforced to secure strength with a minimum of weight. All part require special machinery to secure uniformity and perfection in their construction, which it is perhaps unnecessary to describe in this connection.

The type writer takes rank as one of the principal inventions of the age. In almost every office in every large city may be found one or more of these now indispensable machines. The SCIENTIFIC AMERICAN makes use of these machines in its editorial work, in its correspondence, and in its patent business. By its use, business has been greatly facilitated in these departments, and at the same time uniformity and accuracy have been secured.

Besides the benefits derived from the use of the type writer in business by individuals and large houses, this useful machine has furnished profitable and pleasant employment for thousands of men and women who might otherwise have been engaged in harder work at lower wages. It has proved a great educator, elevating the standard of letter and manuscript writing, often effecting the combination, in one person, of author, compositor, printer, and proof reader.



A NIGHT TRIP IN A BALLOON WITHOUT A CAR.

A NIGHT TRIP IN A BALLOON WITHOUT A CAR.

Public ascensions such as have been made by professional aeronauts from pleasure parks and other accessible places have been so frequent that the exhibitors can no longer expect to reap such profits from admittance fees as heretofore, and, therefore, other means of attracting the public had to be resorted to.

Many ways have been tried, among others a "trapeze artist" ascended with the aeronaut, performing his feats on a trapeze fastened to the car. But scientific men were loth to use such methods.

When aeronauts did away with the car, using instead a simple, saddle-like seat, the load carried by the balloon was greatly decreased, and consequently the balloon could be proportionately decreased in size, making its construction much less expensive and each separate ascension much cheaper, for, of course, a smaller balloon requires less gas. A saddle balloon need not have a capacity greater than 400 cubic meters, while a balloon made for carrying passengers must have a capacity of from 800 to 2,000 kilometers.

One who is fully versed in the technicalities of balloon traveling can make a journey in a so-called saddle balloon with very little more risk than in a balloon with a car, if he is physically strong, ready for all emergencies, and thoroughly practiced in his art. Of course, the saddle is less comfortable than the car. A trip in the saddle seems specially dangerous at night. Our illustration represents a night ascension made by Engineer George Rodeck, who is celebrated for his unusually hazardous voyages. In his longest trip he traveled

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a horizontal distance of 338 kilometers in less than four hours—an average of 84·5 kilometers per hour, a very unusual rate of speed for a balloon.

Rodeck's ball-shaped saddle balloon has a capacity of 450 cubic meters. Four strong ropes provided with swivel hooks are held on the carrier ring, hung under the balloon from the network, and these ropes carry the saddle, the aeronaut's seat. The saddle is provided with stirrups, in which the rider places his feet, so that he has three points of support. As a further safeguard, two other ropes are fastened, each by one end, to the ring, the other ends of which can be fastened to the man's belt, so that a fall from the saddle is impossible under any circumstances. In place of the usual anchor, Rodeck uses a "lance anchor" of his own invention, which he carries on his back fastened to his belt. According to his statement, the balloon can easily be held to a landing place, when the weather is not very stormy, by means of this anchor, which is handled like a spear or lance. This new arrangement has not met the approval of other aeronauts, and the writer is of the opinion that a safe landing could be made only when the air was very quiet. The sand ballast is carried in sacks hung from the ring and the saddle.

At night, even when it is moonlight, an aeronaut would not be able to read his instruments which indicate the temperature, the height, etc., and, therefore, Rodeck has constructed a special incandescent lamp, which hangs from the ring, and which can be lighted by contact whenever needed. This lamp will burn two and a half hours, and, according to the inventor's statement, weighs, with all its appurtenances, 2·5 kilogrammes.

Finally, it may be said that in all probability the saddle balloon will be used only for such ascensions as are made for public exhibition. For scientific observations and for taking bird's eye photographs it is not suitable, and it is doubtful whether it will ever be used for military purposes.—*Illustrirte Zeitung.*

Bent Wood.

We have all seen the beautiful Austrian bent wood chairs and furniture, which owe their popularity, perhaps, as much to their charming design as to their strength and durability; and most of us have had some curiosity to know how they were made. The *Revue Industrielle* explains the matter, at least so far as the processes could be observed at the industrial exhibition at Buda-Pesth. Within a few years the methods of treating the wood have been improved, and the application of the material much extended; carriage wheels, for instance, having their rims made of a single piece of ash or oak, bent to a circle, with great advantage in point of strength and cheapness over those made with fellies sawed in small sections out of straight pieces of wood. The material to be bent is, for furniture, usually red beech, which grows very abundantly in the Hungarian forests. The timber is sawed into strips one and one-half to two inches square, according to the work for which it is intended, and then turned in a lathe into smooth, round rods. These rods are placed in an air-tight case, where they are exposed for fifteen minutes to the action of superheated steam. They are then so soft and pliable as to be easily bent by hand, and are in this condition fitted to iron patterns, well secured, and left to dry. The drying takes from two to eight days, according to the size of the piece. When it is complete, the wood is detached from the pattern and is ready to be joined with other pieces, varnished, polished, and sent out in the shape of finished furniture. —*American Architect.*

Ruby Mines, Burma.

One of the finest sanitariums in India is that of Bernard-Myo, on the broad rolling plains of Enjouk, on the northern slopes of the hills bounding the ruby mining district of Mogok, Burma. Bernard-Myo is over 6,000 feet above sea level. The ruby mining district may have a population of over 6,000 people belonging to many different tribes. The mines are of three kinds: the working of fissure veins, washing in a somewhat similar manner to the hydraulic mining in California, and what may be called placer diggings. The third class of mines is at present the most important. At depths varying from ten to thirty feet, in the flatter lands of the valleys, there occurs a layer of corundum from a few inches to a few feet in thickness. When this corundum is brought to the surface myriads of small rubies glitter in the sun. Almost all the stones are water-worn or of irregular shapes, and it is rarely that a flawless ruby is found. So rare is a ruby of the finest water, that one of three carats is worth ten times the value of a diamond the same size. The district of Mogok is situated between Mandalay and Bhamo, and is nearer to the former place.

Good Cement for Sticking Porcelain on Glass.

Starch sixty parts, finely pulverized chalk one hundred parts. Mix with equal parts of water and alcohol, with the addition of thirty parts Venice turpentine, taking care to agitate the mass with a stick so as to insure its homogeneity.—*The Pottery Gazette.*

Correspondence.

How to Make Blue-Black Writing Ink.

To the Editor of the Scientific American:

Seeing many inquiries in your valuable paper about the manufacture of ink which passes from blue into black, I give you a formula below which I hope will prove satisfactory:

Tannic acid	200 grains
Gallic acid	50 grains
Protosulphate iron	1 ounce
Indigo carmine (neutral)	320 grains
Powdered cloves	5 grains
Water	1 pint

Mix the tannic and gallic acid in the water until dissolved. To this solution add iron, and filter through cotton. Then add the indigo carmine, and lastly the cloves. One good copy can be obtained from this ink.

Detroit, Mich. JOE BRESLER.

Rules for Calculating Cistern Capacities.

To the Editor of the Scientific American:

In your issue of November 24 you copy from the *Sanitary News* a table showing the number of gallons per foot in cylindrical vessels of various diameter. At the time I saw this table, I had just figured on the capacity of a cylindrical tank 5 ft. diameter by 7 ft. depth, and was chagrined to find, upon comparison, that my figures (1,028 gallons) were about 20 per cent greater than according to table mentioned. I tried several other sizes with same result, and concluded that the author of your table must have adopted for his calculations a different measure from the U. S. standard gallon, and upon reading up on gallon measure, I find that the differences between my figures and those of your table correspond exactly to the difference between the U. S. standard gallon of 231 cubic inches and that of the English gallon of 277·274 inches, from which I deduce that the *Sanitary News* is an English paper quoting English measures. This might lead some of your readers astray who like myself have frequent occasion to inquire into the capacity of cylindrical vessels.

A safe rule for finding the capacity of a cylindrical vessel is to take all the dimensions in inches, square the diameter, multiply by the depth, and then by 0·0034, which will give the contents in U. S. standard gallons. Thus, to find the capacity of a cylindrical cistern 25 feet diameter and 1 foot deep multiply:

300″ × 300″ × 12″ × 0·0034 = 3672 (U. S. standard gallons) equal to 3,059 English gallons, the number given in your table. A. MELZER.

Evansville, Ind.

Can Animals Count the Days?

To the Editor of the Scientific American:

Working animals, such as horses and mules, are generally kept on a cotton plantation in a large open pen. In the center there is a feed shed, containing a trough for corn and a rafter for fodder overhead. Stock is fed only twice a day—noon and night. By sun-up, on work days, the plow hands appear, each to catch his "critter," and (who has not seen it?) the forty or fifty mules at their sight move in utter confusion around the shed, hiding behind one another—their exasperating protest to be caught calling forth Sambo's specific billingsgate. But how is it on Sundays? There reigns then an Arcadian peace in the pen. Each mule is paired off with his "chum" (a selective affinity, no doubt), in an angle of the rail fence. Their respective position to one another is like the "Pisces" in the almanac signs; that is, head and tail together. The object is a practical exemplification of the golden rule. To enjoy an untroubled siesta, each head secures immunity from the fly pest, by a close proximity to his friend's "perpetuum mobile." Farm hands may go in and out without producing the least sign of alarm. But, should bridles appear, that disturbs only master's saddle or carriage horses. As to the mules, no extra twitch in tail or ear shows the least suspicion that their owner could possibly be the victim of a mistake. With eyes drooping and head on a level with that of his neighbor's tail, his somnolent torpor is a picture of trust and safety. He knows it is Sunday. I remember well the amused look of my foreman, Essex, when asking him for his opinion on the subject. "Why, in course," said he, "dey knows it's Sunday."

Pertinent to the above query is the other: Do animals know noontime? For the sake of its lively scene let us, some forenoon, go out into a large field. The cotton has been "chopped out," and the bunches, left standing, need stirring with bull tongue or scadder. "Sub tegmine fagi" we watch the bucolic dance enacted by forty couples, two and four footed partners. They "chassez" up and down parallel lines, stimulating and punctuating the rhythm of motion by vigorous shouts, such as: "Jee, Solie! haw, Lisa!" The sight, however, becomes monotonous, and we drop into a pleasing speculation about the yield of the field. Presently we are startled from our reverie by an unearthly "Ee-hung, ee-hung, ee-ee-hung, hung, hung." It is the Nestor of the four-footers that calls thus: "Time for refreshments"—a signal similarly seconded and approved in succession by forty others. We look at our timepiece, and, sure enough, the large hand is about covering the smaller. It is noon. The mule (we drop the figurative), however, is some minutes ahead of time, and owing to his peculiar vindictiveness there ensues a fearful contest for the mastery between him and the driver, which the distant dinner horn only ends. It is during such a contest, when the Solies and Lisas become mulish and Sambo a mule, that the former show such marvelous contempt for the powerful jerks of the check line that their cheeks are rent by inches; in fact, there are few mules in the South that are not thus mutilated, and "sucking water" becomes quite a difficult process for them.

Now, how is it that the mule knows noontime? Does he rely on the infallibility of his timepiece, that warns him that it needs rewinding? Or has he noticed his equally hungry partner, Sambo, who, when reading the end of a row, halts a moment, and turning face northward, anxiously scans the shadow at his feet? Or is the sensitiveness of his back so delicate that he can discriminate between oblique and vertical rays?

We are prone to mystify, and because we are unwilling to grant brute creation the power of reasoning, we call their actions that surprise us "instinct." In the barn yard, stable, and field we never observe this quality of instinct in the young. It is only the old that become wise by experience. Every farmer knows that a mischievous sow, sheep, mule, horse, and cow spoil the morals of their kind, and if he knows his business, he will get rid of them.

The subject is an interesting one, and I should be delighted, for one, if some more of your correspondents would take it up and tell us what they know of our domestic animals. ADOLPH DREYSPRING.

Sing Sing, N. Y.

The Melograph and the Melotrope.

At the recent meeting of the American Institute of Electrical Engineers in this city, a pair of new instruments for the recording and reproduction of musical performances were exhibited. They are the invention of Mr. B. Abdank, a man of remarkable scientific attainments and peculiar genius in respect to mechanics. The new devices were described by Mr. Hering as follows:

The melograph is an apparatus for recording what has been played on the piano, and the melotrope is an instrument for reproducing this music from the record made by the melograph. The melograph consists of a system of contact points or keys, which are fastened under the keyboard of a piano, and are so arranged that when a key is depressed the contact is closed. These keys are then connected to an instrument like the ordinary Morse ink recorder, so that when each key is depressed the mark will be made on a strip of paper corresponding in position to the position of the note on the piano, and as each note is represented by a key and by corresponding recording apparatus, each note will, on being played, be recorded on a strip of white paper like this, in the form of a dark line which, perhaps, you can see. This paper is, therefore, a record of the notes that have been played by the player. It not only records the notes that were played, but the length of the line records the time during which that note has been held, so that it is not only a record of the note itself, but of the time of the note. This record is then passed through an intermediate apparatus called a perforator, the object of which is to perforate a piece of stiff paper with rectangular perforations corresponding to these lines of the melograph record. This is done by means of an electric apparatus which consists of a little square punch, which travels up and down very rapidly. It is driven by an electric motor. I understand the lines on this paper are first run over with a puncturing pin. Then this paper is passed over a series of contacts. Whenever the paper is punctured, connection will be made, which connection will work this little punch at a place corresponding exactly to the place of this line on this record. In other words, this record on stiff paper is an exact counterpart of the other, only that it is perforated with smooth rectangular holes, whereas this is, originally, merely a written record. This record is then ready for the melotrope—the reproducing apparatus.

The melotrope is merely mechanical in its operation, and is intended, as far as possible, to imitate the motion of the fingers in playing upon the keys of the instrument. The melotrope is provided with a long roller, which extends over the keyboard of the instrument that is to be played. The roller is provided with a series of grooves, in which are strings, which connect with little fingers, and these press upon the keys of the piano. On turning the cylinder, the fingers will be depressed and strike the keys. There are intermediate devices which cannot be properly explained without diagrams.

By means of these inventions the composer, by the act of playing, records his notes, and may subsequently reproduce their sounds by mechanical aid.

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SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

The application of the pendulum to the measurement of time dates from 1658. In that year Huyghens applied it to clocks. Singularly enough, this has proved to be the only practical use of any importance to which the pendulum could be adapted. The fact that millions of clocks have been made which depend on the pendulum for regulation proves the great value of Huyghens' invention.

A simple model, showing the application of the pendulum to clocks, is illustrated in Fig. 1. It is readily made, and serves to show how the pendulum acts in the regulation of a clock, and is useful for measuring seconds in experimental work. The frame is made entirely of hard wood. The three parallel plates are connected by wooden studs. The wooden arbor of the scape wheel is provided with steel wire pivots, the outer one being prolonged beyond the front plate to receive the second hand. The scape wheel consists of a disk of wood about three inches in diameter, provided with a circular row of steel pins, uniformly spaced and projecting from the face of the disk parallel with the arbor. With a disk of the size given thirty pins will be sufficient, with a larger disk sixty pins may be used.

Above the scape wheel arbor there is a wooden roller furnished with steel wire pivots. In the roller is inserted a steel wire forming the escapement or crutch, the ends of the wire being bent inward to form pallets which engage the scape wheel pins in alternation. The rubbing surfaces of the pallets are flattened and polished and the ends are beveled. In the roller is inserted a wire which extends downward obliquely through a hole in the middle plate, and is finally bent into an oblong loop extending rearward. In a split stud in the back piece is inserted the flattened upper end of the pendulum rod. A small rivet passes through the upper extremity of the rod, and prevents it from slipping through the split stud. The rod passes through the oblong loop above referred to, and is provided on its lower end with an adjustable weight of 1½ to 2 pounds.

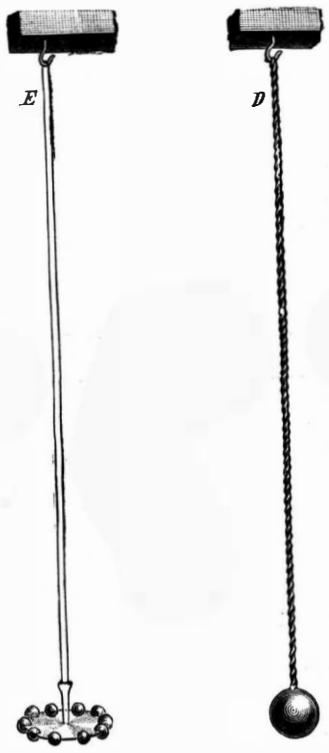

Fig. 4. Fig. 2.

TORSION PENDULUMS.

The scape wheel arbor is provided with a circumferential V-shaped groove forming a very small pulley for receiving the driving cord. Upon the middle plate above the arbor is fixed a circular block having a deep V-shaped circumferential groove for receiving and holding the endless driving cord, which passes round the arbor and grooved block as shown, and also passes around the pulley block attached to the weight. It is necessary to have the V-shaped grooves very deep and very narrow to enable them to pinch the driving cord. To insure uniformity in the action of the cord and weight, it is advisable to place in the second loop of the cord a pulley and connect with it a very light weight. When the driving weight has nearly run down, the cord may be pulled upward over the grooved block and fastened. The pendulum rod is made very thin and flexible at the upper end by hammering. The rod is made of a wire of sufficient diameter to prevent springing by the action of the escapement, and the pendulum bob is made adjustable. The distance between the center of the bob and the split stud is 39·1012 inches.

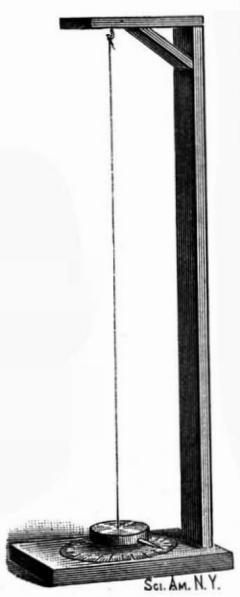

Fig. 3.

TORSION PENDULUM.

The motion of the pendulum is a result of the downward pull of gravitation and the restraint of the pendulum rod. It is forced by gravity to move until the lowest point of its arc is reached, when the momentum acquired carries it forward and upward, in opposition to the earth's attraction, until its momentum is overcome by gravity, when it stops and is again drawn down by gravity, causing it to return to the lowest part of its arc and repeat the movement just described, but in the opposite direction. But for friction of the air and of its parts, the pendulum would swing on indefinitely.

A torsion pendulum is one that depends for its action upon the twisting and untwisting of an elastic suspension. The simplest pendulum of this class is the toy known as the return ball. It consists of a wooden ball attached to the end of an elastic rubber cord. By grasping the free end of the cord and swinging the ball so as to cause it to roll in a circular path on the floor, the cord will be rapidly twisted. If, after twisting, the cord be fastened to a support, as shown in Fig. 2, it will be found that the ball will rotate rapidly by the untwisting of the cord. The momentum of the ball acquired during the untwisting will again twist the cord, but in the opposite direction. This pendulum will run more than an hour with a single winding. The period of such a pendulum, taken at random from a pile of return balls, was 1½ minutes, the rubber cord when not extended being about a foot long.

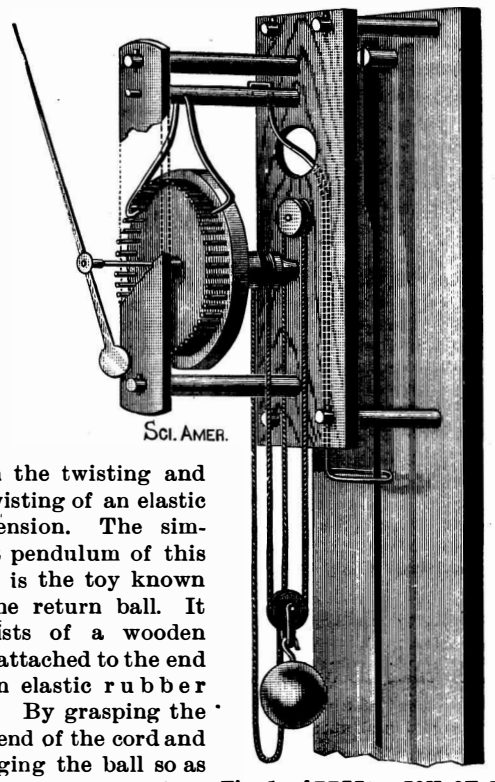

Fig. 1.—APPLICATION OF THE PENDULUM TO CLOCKS.

By means of apparatus similar to that shown in Fig. 3, Coulomb determined the laws of the torsion of wires. The wire by which the weight is suspended is firmly secured to the hook, and the weight is provided with an index. The angle through which the index is turned from the position of rest is the angle of torsion. After turning the weight and releasing it, the elasticity of the wire returns it to the point of rest and the momentum of the weight carries it forward, twisting the wire in the opposite direction, until the weight reaches a point where the momentum of the weight is overbalanced by the resistance of the wire, when the wire again untwists, turning the weight in the opposte direction. These oscillations continue until the force originally applied is exhausted in friction. The oscillations within certain limits are very nearly equal.

A torsion pendulum, with a bifilar suspension, is shown in Fig. 4. The wheel is formed of a disk of metal, with a series of split lead balls pinched down upon its edge. The wheel weighs 1½ pounds. Its diameter is four inches. It has a double loop at the center for receiving the parallel suspending wires, which are ⅜ inch apart and 5 feet long. No. 30 spring brass wire was used in this experiment. The period of the pendulum was five minutes.

The torsion pendulum has been successfully applied to clocks. Either of two results may be secured by its use. The time of running may be prolonged in proportion as the period of the torsion pendulum is longer than that of an oscillating one, or the number of gear wheels required in the clock may be greatly reduced. Ordinary clocks constructed on this principle run a year with a single winding. Clocks have been made on this plan which would run for one hundred years.

In the same year that Huyghens applied the oscillating pendulum to the clock, Hooke applied the spiral spring to the watch balance, thereby causing it to act as a pendulum. The principle of Hooke's invention is illustrated by Fig. 5. The apparatus here shown has a vibratory period of one second. The staff rests at the bottom in a small porcelain saucer and turns at the top in a wire loop secured to the base board. The disk on the staff is loaded at its periphery with lead balls. A large watch main spring or music-box spring is attached to the staff and to a fixed standard. The oscillation may be quickened by using a stiffer spring or by removing some of the balls.

In Fig. 6 is represented a model of a pendulum of recent invention which has been applied to clocks with some success.

Two cross bars are supported from the base by two wires. In the lower cross bar and in the base is journaled a wire having a hook at the upper end. This vertical wire carries a curved arm, to which is attached a thread having at its extremity a small weight, such as a button. The propelling power in this model consists of an elastic rubber band placed on the hook on the vertical rod, and received in a hook on the little crank shaft in the upper bar. The rubber band is twisted by turning the crank, and the crank is prevented from retrograde movement by the wire catch at the side of the bar.

As the arm is carried around by the power stored in the rubber band, the weight on the thread is thrown outward by centrifugal force. When it reaches one of the side rods, it wraps the thread several times around the rod, thus holding the arm until the thread is unwound by the action of the weight, when the arm describes another half revolution and the operation just described is repeated.

Antiseptic Values of Various Chemical Substances.

At a recent meeting of the Society of Chemical Industry, London, Mr. C. T. Kingzett read a paper as above. The author contended that all processes of fermentation were more or less similar in character, and that antiseptics behaved similarly toward all the organized ferments. It is not sufficient to kill the organism present, but the antiseptic reagent, to be of any real value, must also be capable of oxidizing and destroying the active poisons or toxic principles which have been produced by the micro-organisms. Most of the chlorides, nitrates, and sulphates of the metals have been examined by the author, and he has tabulated the times at which putrefaction begins in solutions of beef extract to which known quantities of these various salts had been added. Copper and mercury salts were found to be most efficient in arresting decay. The change could be readily detected by the smell, and a color change from red to scarlet, due probably to aerobic micro-organisms, also marked the commencement of putrefaction. Various organic antiseptic reagents were tried, and the periods during which they were capable of staying putrefaction noted. The new antiseptic salufer (sodium fluosilicate) was compared in antiseptic value with sanitas and the "bactericides." By far the most powerful of all antiseptics is; however, corrosive sublimate, but unfortunately this salt has no oxidizing properties, and therefore has no value for destroying the poisons produced in putrefaction. The properties of salufer appear to have been exaggerated; all acids are good antiseptics, and phenol, although limited in its uses, is to be recommended. The investigation has also shown that chloral has marked antiseptic properties, and that free boric acid is superior to borax and to the neutral borate. The bactericides are a class of antiseptics introduced by the author, which consist of any of the well known and approved antiseptic agents to which a five-volume solution of hydrogen peroxide has been added. The presence of this latter compound in the solution is of great value in supplying sufficient free oxygen to bring about destruction of the poisons produced in fermentation.

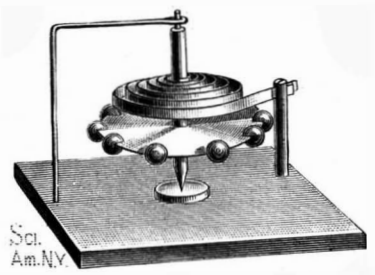

Fig. 5.—THE BALANCE.

Diphtheria from Cats.

The British *Medical Journal* mentions a report made to the Central Board of Health of Melbourne, Australia, describing an outbreak of diphtheria in which the cases occurred almost simultaneously in the neighborhood of Daylesford. The local health officer's report presents strong *prima facie* evidence that the children contracted the disease from cats, numbers of which animals were dying in the neighborhood.

Fig. 6.—FLYING PENDULUM.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Charles Ludvik, Brooklyn, N. Y. It is of that class in which a winged piston revolves in a cylindrical steam or fluid chamber having abutment chambers opening into opposite sides, in which rotary fluid abutments are arranged to alternately cut off the annular space around the piston and be retracted to permit the piston wing to pass, the invention providing for a light construction with simple means for reversing the engine.

CAR COUPLING.—George W. Dawson and Benjamin F. Cleveland, of Sac City, Iowa. A sliding plate fitted in a cavity in the drawhead has a projection engaging a pivoted bar to raise and lower the coupling pin, which is placed in position for coupling by a lever at the side of the car, and when the cars come together the entrance of the link in the drawhead causes them to couple automatically.

STATION INDICATOR.—Philip A. Shanklin, William R. Swager, and William Swager, of Sandoval, Ill. It is designed for street and railway cars, and adapted to be operated by a lever, pull rope, or other power, the invention covering a novel construction, combination, and arrangement of parts.

CABLE RAILWAY.—John Wilde, Providence, R. I. It is designed for use as a conveyor of coal, stone, gravel, and similar articles, or for conveying work, merchandise, or change from one room to another in the same building or different buildings, the invention covering various novel features of construction and combinations of parts.

PUMP.—William Keast, Russell Gulch, Col. It is specially designed for raising impure water from mines and other places, and to separate the impurities from the water before the latter reaches the surface, the invention covering various novel features of construction.

COTTON PRESS.—George J. Loyall and James M. Moyers, Richmond, Va. It is adapted to be operated by hydraulic power, the construction being designed to compress eight hundred to a thousand pounds of cotton to a bale of the usual size containing only four to five hundred, while doing the work with less labor and in the same time.

SAW MILL FEED.—Newton Hoffman, Elizabeth, West Va. Friction cone pulleys are arranged in peripheral contact and placed between the source of power and the carriage pinion, for propelling the carriage of saw mills or other machines back and forth at variable rates of speed, or holding it stationary as desired.

Miscellaneous.

VENDING APPARATUS.—Henry Gates, Brooklyn, N. Y. It has a magazine with vertical tubes, in which are placed goods made up in packages to be delivered to a sliding drawer in exchange for a coin dropped in a slot, the machine being simple in construction and easy of operation, while it is designed to be impossible to work it by a coin of other denomination than that arranged for.

SHOULDER BRACE.—Mattie A. Van Alstine, Armstrong Springs, Ark. Its construction is such that when applied to the person the brace will not cut at the arms, pressure being taken away from the arm pits, while it is designed to effectually restrain a person from growing round-shouldered, without restricting the free action of the lungs.

NEEDLE THREADER.—James M. Miller, Richmond, Va. The body of the threader is formed of a single piece of spring wire doubled upon itself to form nearly parallel arms, to the extremity of one of which the thread hook is rigidly attached, the thread being drawn through the needle by direct pressure, the elasticity of the arms serving only to project the hook through the needle eye.

CALCIMINE.—Charles W. Hurd, Glens Falls, N. Y. This is a new composition of matter for a wash or finish for the interior walls of buildings, and consists of shell marl and sufficient glutinous matter to prevent it rubbing off when applied, with colo ing matter as desired.

RULING AND PRINTING MACHINE.—George T. Patterson, New York City, and James W. Dickieson, Brooklyn, N. Y. This invention covers a novel construction and combination of parts making a machine for ruling sheets of paper and printing matter in perfect alignment and impression on the ruled sheet.

VEHICLE SHAFT SUPPORT.—Andrew T. Sears, Bridgeport, Conn. It consists of a frame with means for attaching it to a carriage spring or cross bar, a bar being pivoted to the frame for engaging and supporting a pair of shafts, for holding the shafts of a vehicle up out of the way when not in use.

MAIL BAG.—Carson C. Cook, Camas, Idaho Ter. The locking devices and the formation of the bag at the mouth are simplified, and a means provided whereby, when the bag is locked, matter cannot be abstracted without an indication on the surface of the bag denoting the attempt.

BOOK HOLDER.—Edward H. Roys, Spencertown, N. Y. It consists of pivoted and folding bars, with inwardly extending clips at the outer ends of arms, the holder offering no obstacle to the free turning of the pages of the book, and being likewise adapted for holding manuscripts, its construction being very simple.

BOOK SUPPORT.—James W. Coultas, Clinton, Ill. It is designed for holding dictionaries and other large and unwieldy books, the support having hinged side frames which close together to shut the book with a spring, the side frames, when opened, throwing the springs out of action, so that the book may lie at rest in opened position.

WHIFFLETREE COUPLING.—B. F. Alvey, St. Mary's, Ind., and Frank Leseure, Marshall, Ill. [The latter only to be addressed in relation to the patent.] This invention provides a simple device for coupling whiffletrees to doubletrees to allow of free horizontal play to both trees without rocking motion of either and without strain on the pivot bolt which connects the trees.

AUTOMATIC PUMP.—Francois Romain, Grenoble, France. The device is provided with a water cylinder, pressure-regulating mechanism, and air pump, for operating upon a cask in which beer or liquor is stored, whereby air may be forced in and the contents of the cask forced out of the discharge orifice or faucet.

EGG PACKAGE.—Arthur S. Hoyt, Hoboken, N. J. It consists of a casing formed from a blank of pasteboard, with a removable cell frame, consisting of longitudinal strips interlocking with cross strips, and forming therewith and with the casing a series of egg cells, making a package adapted to be packed in quantities in crates without liability of breaking the eggs.

TOBACCO CURING.—Edwin R. Bardeen, Aiken, S. C. This invention provides an apparatus for admitting into the curing house in which green tobacco is hung dry heated air or moist heated air alternately, under absolute control of the attendant, for drying and sweating out the nicotine and empyreumatic oils, and quickly curing and bleaching the tobacco to the desired color.

ELECTRIC LETTER BOX.—Charles F. Harms, of Hoboken, N. J. This improvement is in the form of an electric attachment whereby the circuit will be closed during the mechanical lifting or removal of the cover to insert mail matter in the box, thereby giving an alarm, which may be located at any desired point.

SHIRT.—Charles and Jacob Falkenberg and Morris Jones, New York City. This invention relates to woolen shirts having attached collars which may be turned in so that a linen collar can be worn, and the construction of the collar band and attached collar is such that when the collar is turned in, all uncomfortable fullness at the neck is avoided.

HAT OR BONNET HOLDER.—Nancy E. Veatch, Gales Creek, Oregon. The device consists of a coil of fine wire with fastening devices at its ends for securing the coil to a hat or bonnet, the coil being of suitable length to pass under the hair of the wearer and of sufficient elasticity to close snugly between the hair and head.

VALVE.—Johan A. Brudin, New York City. It is designed especially for use in connection with flasks of aerated waters, or "siphons," and has a pouch-like packing, a spring-pressed piston arranged in connection therewith, and a thumb piece to throw the piston against the tension of its spring.

SCAFFOLD BRACKET.—William H. Higgins, Forest City, Pa. The bracket proper consists essentially of a flattened forwardly extending tongue and an outwardly extending projection formed with claws, the invention being an improvement on a former patented invention of the same inventor.

STUMP EXTRACTOR.—John Cornelius, Evansville, Ind. Combined with a chain wheel and a worm wheel formed in sections arranged on opposite sides of the chain wheel, a worm is fitted to mesh with the sections, the machine being drawn to face the direction of greatest strain, changing its direction as one, two, or more stumps of a group are pulled.

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Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p.28.

Lathes for cutting irregular forms. Handle and spoke lathes. I. E. Merritt Co., Lockport, N. Y.

Patent swing cut-off saw, with patent shield for saw. Rollstone Machine Co., Fitchburg, Mass.

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NEW BOOKS AND PUBLICATIONS.

A DICTIONARY OF TECHNICAL AND TRADE TERMS. London and New York: Ward, Locke & Co. Pp. xxxv, 283. Price $2.

This dictionary covers principally terms related to architectural design and building construction, and is remarkable for the completeness with which it gives the derivations of and French and German equivalents or synonyms for the various terms. The dictionary is distinguished by a comprehensiveness of terms and a fullness of their definitions calculated to make it practically useful to artisans and mechanics in a variety of industries.

TWENTY YEARS WITH THE INDICATOR. By Thomas Pray, Jr. New York: John Wiley & Sons. Pp. 284. Price $2.50.

Mr. Pray's work under this title has already become well known to engineers, but this edition represents what has formerly appeared in two volumes, all now newly arranged and complete in one volume. It is written as a practical text book for the engineer or the student, with no complex formulæ, and with many illustrations and rules as to the best way to run any steam engine to get the most economical results, showing how to adjust valves and to work out horse power, determining the amount of steam or water per horse power, the economy of fuel, etc.

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DECEMBER NUMBER.—(No. 38.)

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16. The Villa Reiss, near Cronberg, Taunus Mountains, Germany. New residence of the Empress of Germany.
17. Miscellaneous contents: Publication of designs.—The Drexel building, Philadelphia.—Ancient sanitation.—Effect of adding sugar to cement.—The New York safety dumb waiter, illustrated.—The automatic regulation of the temperature in houses, illustrated.—The Aldine fireplace, illustrated.—The Howard combination heater, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) C. F. asks for a receipt or two of a method for making heavy felted goods waterproof, if such a thing can be done. A. Stretch the piece in a frame and rub with beeswax on wrong side. Then melt in with a hot smoothing iron. Or use paraffin in the same manner. Also see SCIENTIFIC AMERICAN SUPPLEMENT, No. 317, which we can send by mail for ten cents.

(2) H. W. O. asks: Can you give me a receipt in your Notes and Queries column to make a solution to brass-plate with? I have a five-gallon tank; the zinc goes to the bottom, and the copper deposits. A. The articles must be prepared with great care, by pickling, etc., so as to be perfectly clean. Then for bath use:

Best sheet brass	1 ounce.
Nitric acid (by measure) about	4 "
Water	2 "

After action ceases, if no brass is left undissolved, a little must be added, as an excess of metal is requisite. Pour off the solution from undissolved brass and dilute with three to four times its volume of water, add ammonia (0·880) until all is clear blue in color, then add cyanide of potassium until the color turns yellowish. It should stand twenty-four hours, and be filtered before use. Use not less than 2 volts E.M.F. Use a brass anode. The anode must not be too large or too small. Watch color of deposit, and lower or raise anode until the deposit is yellow. A large anode gives zinc, a small one copper. Keep article quiet while in bath.

(3) P. J. R. asks how he could stain or dye cheaply sawdust the following colors, viz., bright yellow, bright green, light blue, bright red, and if possible a pure white. A. Use aniline colors or Diamond dyes. You will not succeed in producing pure white. Bleaching with chloride of lime or javelle water will give you an approach to it, but may injure the fiber.

(4) W. R. asks: 1. How many Grove's batteries, zincs 2 inches wide by 3 inches long, and platinum 1 inch wide by 3 inches long, would it take to operate a 20 candle power incandescent lamp? A. About 30 cells. 2. How is aniline green manufactured? A. Spons' Encyclopedia, part II., which we can supply for 75 cents, contains a treatise on aniline colors. 3. If tin foil pasted on a board and cut into small squares about a quarter of an inch apart, and connected with the secondary] binding screws of an induction coil, would give a light sufficient to light a room 12 feet by 12? A. No.

(5) A. A. F. asks: What is the paste composed of that stereotypers use for making matrix for moulding plates or "turtles" for the web perfecting printing presses? A. Take 5 ounces flour, 7 ounces white starch, 1 large teaspoonful powdered alum, and 4 quarts water. Put the flour, starch, and alum in a saucepan and mix in a little of the water, cold, to about the consistency of thick cream. Then gradually add the remainder of the water, which must be boiling, stirring well meanwhile, to prevent lumps. Then put the whole of it over a fire until it boils. Then allow it to stand until quite cold. When you are ready for work add Spanish whiting, the mixture not to be too stiff, to spread readily with a paste brush. Put through a fine wire sieve with a stiff brush, and it is ready for use.

(6) J. P.—For the horse power of an engine, multiply the square of the diameter of the cylinder by the decimal 0·7854, and this product by eight-tenths of the boiler pressure, if the cut-off is not known. Multiply the last product by the speed of the piston in feet per minute (or twice the stroke in feet and decimals, multiplied by the revolutions per minute). Divide the last product by 33,000 for the horse power.

(7) C. M.—For etching on steel use a ground made of asphalt and beeswax equal parts melted together. Warm the article, and even the ground with a dabber made of cotton in a silk cover. Scratch the figure, and bite with nitric acid mixed with three to four parts water. If you wish to stamp the figure, put a little linseed oil with the above ground to make it as thin as printer's ink. Print with a rubber stamp, and cover parts not required to be bitten with a varnish of asphalt and turpentine.

(8) A. M. M. asks: Is there any place in United States where sheet tin is manufactured? A. We know of but one, the United States Iron and Tin Plate Company, Pittsburg. We export block tin, and import tin plate.

(9) C. A. B. asks the position of the Brooklyn Bridge by the points of the compass. A. It lies very nearly north and south, or NNW. by SSE.

(10) A. B. F. asks how silver-plated ware is treated after being taken from the plating bath. A. Dipped in a boiling solution of caustic potash, one-fourth pound to a gallon of water, then rinsed in hot water, dried in fine boxwood sawdust, and burnished.

(11) G. S. asks: 1. Do ashes made from soft coal form a good material to cover a steam pipe

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with, laid in a wooden box? A. Yes. Use the fine light ashes from behind the bridge wall. It is the best. If not enough, sift the ashes under the grate, using the fine ash.

(12) A. P.—A method of making malleable iron casting is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 399, and a very complete account in Spons' Workshop Receipts, third series, which we can mail for $2.00.

(13) W. T.—The finishing cuts on the ends of pencils are made with a pair of sharp knives that work like scissors, but do not meet. The knives are in a machine, the pencils being passed through automatically.

(14) C. E. L.—There are several telescopic comets within or near the solar system now. The one recently discovered at the Lick Observatory can be seen with small telescopes as a small star with a faint tail about half a degree long. Its position on the 17th November was R. A. 3 h. 57 m., dec. south 2° 30′. It is computed to be visible during one year, in the evening, until March, 1889, then in the morning and evening until November, 1889.

(15) A. McC. — The steepest railway grades are said to be in Switzerland, 369 feet to a mile. Many railways have short grades of 200 or more feet to a mile. The momentum of a locomotive and train will enable the ascent of very steep grades that are short. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 395.

(16) G. W. H.—The expansion of steam pipe for a rise of temperature of 200° is 1½ inches per 100 feet or 1·97 inches for 130 feet. This is for a change from 60° to steam heat of 20 pounds pressure. For a pressure of 50 pounds add three-tenths of an inch per 100 feet. All sizes of pipes expand alike with equal change in temperature.

(17) G. C. S.—The outer planets take their apparent retrograde motion from their position in opposition to the earth, when the earth, moving faster in its orbit than the motion of the planets, makes their motion apparently backward among the stars. You will notice this only by close observation when an outer planet is near opposition. The time and amount varies for the different planets. See "Popular Astronomy," by Newcomb, $2.50, which we can mail.

(18) A. O. asks: Does a horse travel with less fatigue over a flat than a hilly country? A. The theory that the ease of down hill travel compensates for the difficulty of going up hill is a great mistake. Holding back is not natural for a horse; it often worries him more than an uphill pull.

(19) R. C. G. asks the way to line a shaft. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 190.

(20) W. A. asks: What sizes of wire will be required to supply currents for separate plants of three, six, and twelve arc lamps? A. In general terms, the larger the wire, the better. No. 8 or 10 wire suffices.

(21) C. G. writes: 1. What causes a show window to "perspire," as they say? A. The condensation of moisture from the air, largely due to the gas burners and presence of people. 2. How can it be prevented? A. By ventilating at the top thoroughly.

(22) J. C. S. writes: A owes B $500.00, all of which he is unable to pay at once, and B agrees to extend the time twelve months, provided A will pay him part of the principal and interest in advance on the unpaid part at the rate of 8 per cent. A accepts this proposition and pays B $200.00, which is part principal and interest on the unpaid part. How much will A owe B at the expiration of twelve months? A. Let x = unpaid portion of principal, then $500 - x$ = paid portion. We then have the equation—

$$500 - x \times 0{\cdot}08\, x = 200.$$

Solving this, we find:

$$x = \$326.09.$$

This is the portion of the principal that is to be paid at the end of twelve months. In addition to this, 8 per cent has to be paid on the rest of the principal, or on 500 − 326.09 = 173.91. Eight per cent on 173.91 is 13.91. Adding this to 326.09 we have 340.00 as the total to be paid at end of twelve months.

(23) W. J. L.—The piston of a moving engine travels forward and backward in its relation to the cylinder. It always moves forward in its relation to the roadbed or track when the engine is running forward, and always backward when the engine is running back.

(24) M. S. asks if a good grafting wax can be made sufficiently soft in consistency to be applied when grafting without requiring heat. A. Mix equal parts of beeswax and resin; add tallow until a proper consistency is attained.

(25) A. W. asks: About what is the market value of attar of roses? A. From $40 to $100 per ounce is given as the range of price.

(26) F. P. asks: 1. How can I mix kerosene and lard for a lubricating oil, so that it will not separate? A. Wash the lard well with hot water, have perfectly dry, and it will mix with kerosene. 2. Would it injure drinking water to use a copper pail? A. Not if the pail is kept bright. For Vesuvium, see SCIENTIFIC AMERICAN, Dec. 8, 1888, query No. 9.

(27) F. S. M. writes: I have an electric bell arrangement in my house, and the zinc rod in the battery gets coated with a kind of salt, and occasionally the battery refuses to work until I scrape the zinc. How can I prevent it? A. Add a little hydrochloric acid to your solution. The porous cell is probably exhausted and needs replacing.

(28) A. C. M. asks: Could I not charge a storage battery by means of a dynamo run by a windmill, by using an automatic arrangement that would complete the circuit only when energy greater than that in the storage battery was being developed by the windmill? A. You could construct an automatic arrangement based on the gas evolved when the battery is fully charged. A single cell could be sealed, and the pressure of gas in it could be made to actuate a mechanical cut-off when the pressure reached a definite point. This would provide for cutting off the current. It might be arranged to do the whole work of throwing in and out of circuit.

(29) G. F. writes: I have a mixture of white castile soap and eggs, which looks like soft soap. Could you tell me of something that would "cut" the soap, *i. e.*, take the greasy look out of it, and make it so it will not be stringy, but be in separate particles? A. A little salt solution will tend to make the soap curdle and form in clots.

(30) J. B. asks: 1. Is not hot air a better supporter of combustion than cold air? A. It tends to increase the engery of combustion, and to produce a much higher temperature. 2. Give a scientific explanation of how sparks get out of the fire box of a locomotive. Is not the creation of a vacuum in front end the cause? A. The creation of what is termed a "partial vacuum" is the cause.

(31) R. A. R. asks: Can you give me a recipe for making a preparation that will keep the frost off windows? A. Ventilate the window casing at the top. Sponge the windows with glycerine and water.

(32) A. S. writes: I have read somewhere that you can extend the carbon surface of a porous cup battery by packing powdered coke around the porous cup. Will you please tell me if the coke should be just poured around loose or be packed in tight. A. Break coke to size of beans, screen out dust, and pack loosely. For description of telephone, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 142.

(33) S. M. D. asks: 1. Have not inventors in the United States done more to develop modern practical scientific appliances than inventors in any other single country in the world? A. United States patents exceed in number those of any other country. 2. Have scientific men in Great Britain or France done more to develop theoretical and technical science than the same class of men in any other single country? A. It is impossible to answer your second query.

(34) Carpenter asks: 1. About what year were "cut" nails first introduced? A. The first patent for a machine for "cutting nails" was issued to Josiah G. Peerson, of New York, March 23, 1794. As early as 1606 Sir Davis Bulmer obtained a patent for cutting nails from a rod by water power. 2. What is the name of the wood from which Cuban cigar boxes are made? It much resembles mahogany, but lighter and softer. A. Spanish cedar.

(35) Reader writes: In your paper of November 24, 1888, page 325, appears a table of the number of gallons of water in cylindrical cisterns. The estimates given in this table differ from a table on page 695 of Moore's "Universal Assistant." I would like to know which is correct. Please answer in your next paper. A. The *Sanitary News* table refers to the imperial gallon of 277·274 cubic inches. Moore's table refers to the American gallon of 231 cubic inches.

(36) R. D. asks: 1. How long will an open circuit battery (best make) ring a bell continuously before it becomes polarized, and how long will a closed circuit battery do the same before it runs down? A. It depends on the resistance of the bell magnet and on the general features of its construction and on the size of battery. Ten minutes to one hour for the open circuit, and ten hours and upward for closed circuit. 2. Which line will a battery run the longest on ringing a bell continuously, one a mile long or one 1 foot long, using the same size wire and the same bell in each case? A. If the bell and battery are properly proportioned, it will run longest on the short line.

(37) T. A. M. C. V. asks: 1. What is the pattern of Bunsen cell that may be used for charging accumulators, its size and capacity, and its intensity in amperes? A. The so-called Bunsen cell generally contains a carbon prism in the center, within a porous cup, which is surrounded by a plate of zinc, bent into a nearly complete circle. For the porous vessel, electropoion fluid, often described by us, is used. For the outer cell, water or dilute sulphuric acid. Such cell gives about 2 volts electromotive force, and its resistance may vary from 0·200 to 1 ohm, according to size, strength of solution, etc. With low external resistance, therefore, it may give 10 amperes. 2. What is the rule to calculate the number of such Bunsen cells required to charge an accumulator or several of them of two volts E. M. F.? A. Always arrange storage batteries in series for charging. Then for intensity of current allow 18 amperes, and for electromotive force allow 2·25 volts, or about 40 watts, per cell. If charging with a battery, arrange it so as to produce this current. 3. Is it necessary that a dynamo should have the same voltage and amperage as the accumulator for the purpose of charging, provided the number of watts be the same? Or may the voltage of the dynamo be lower, provided the amperage be higher? Can a dynamo of $4\frac{5}{10}$ amperes and 100 volts charge an accumulator, as good as one of 6 amperes and 75 volts, or 10 amperes and 45 volts, and making all of them the same combination in watts? A. The dynamo should have 12½ per cent more voltage, and should produce a current of 18 amperes intensity. The voltage and amperage cannot compensate, one for the other. The above rate is the correct one. More voltage would be uneconomical, and less amperage would be slow. Hence the third dynamo named would be the best, and should be given not less than $\frac{45}{2.25}$, or 20 storage cells in series to charge.

TO INVENTORS.

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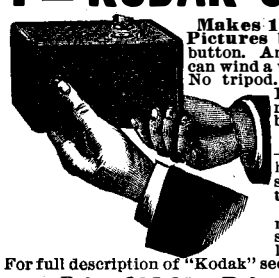

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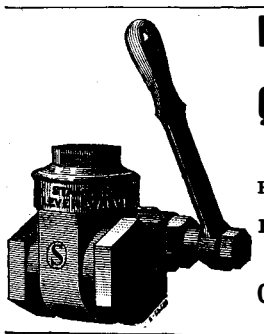

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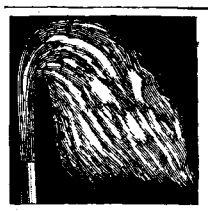

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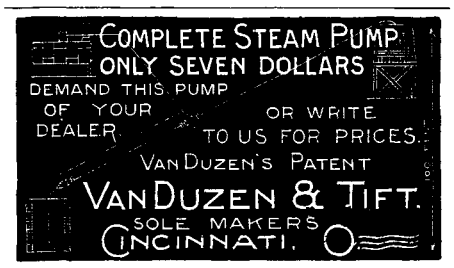

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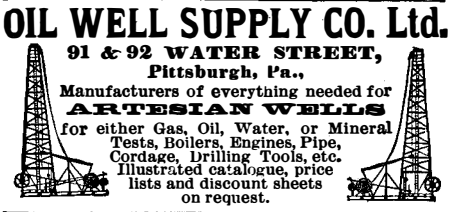

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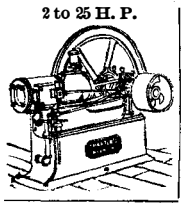

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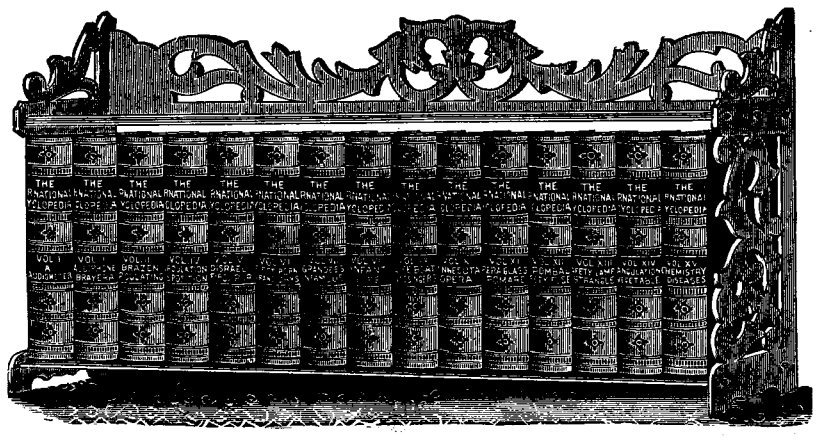

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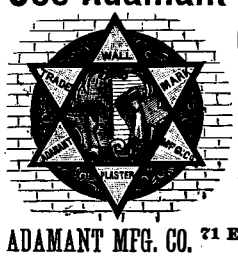

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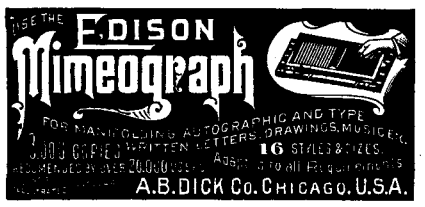

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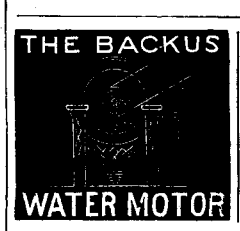

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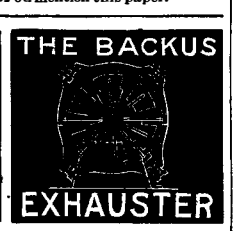

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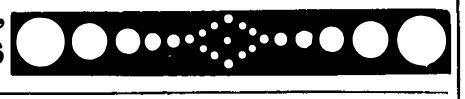

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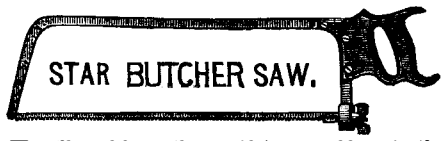

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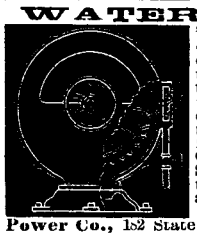

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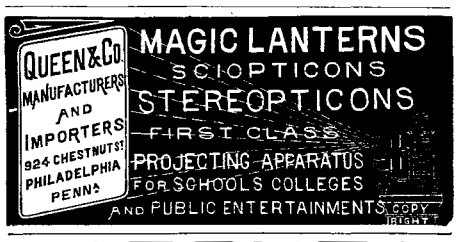

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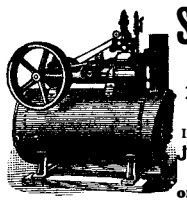

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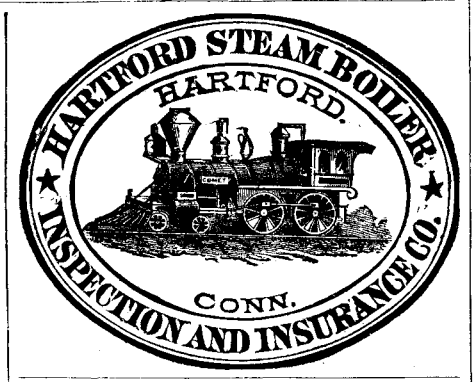

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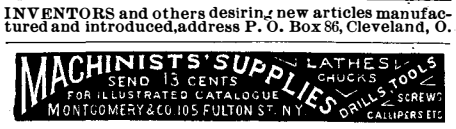

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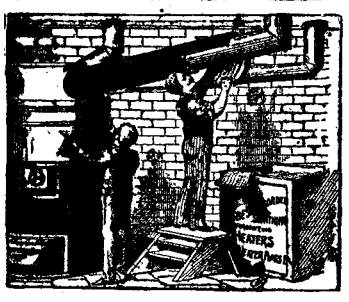

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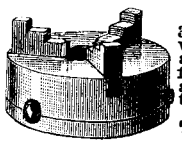

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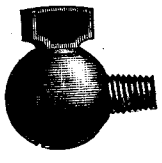

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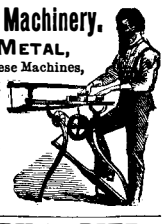

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